FINAL

LIGHTING STUDY
EEAP PROGRAM
FOR
LETTERKENNY
ARMY DEPOT

U.S. ARMY ENGINEER DISTRICT, NORFOLK

CORPS OF ENGINEERS

NORFOLK, VIRGINIA

PERFORMED BY

ENTECH ENGINEERING, INC.

READING, PENNSYLVANIA

VOLUME 1 OF 3

SEPT
~~JUNE~~ 1995

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
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Marie Wakefield,
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INTRODUCTION

A lighting study, on selective buildings at Letterkenny Army Depot, has been performed by a team of engineers and technicians from Entech Engineering, Inc. with experience in over 500 similar investigations since 1980. Entech has developed powerful, sophisticated computer programs which analyze building energy usage and cost savings. An extensive list of potential Energy Conservation Opportunities and operations has been identified and verified by Entech personnel, who have become thoroughly familiar with the lighting in the surveyed buildings.

The Executive Summary of this report provides a synopsis of all cost-effective measurers investigated. The other sections of the report provide a more in-depth analysis of procedures, energy usage patterns, and recommendations.

This report is an important tool for identifying cost-effective projects, and should provide the framework for a long-term *Energy Management Program.*

Entech appreciates this opportunity to serve as Letterkenny's *Energy Management Consultants* on this very interesting investigation.

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ENERGY ANALYSIS

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1.0 EXECUTIVE SUMMARY

1.1 Project Authorization and Objectives

This project was authorized under the general provisions of Executive Order 12902 with specific implementation under the Army's Energy Engineering Analysis Program (EEAP). Entech Engineering, Inc. was commissioned under Contract DACA01-94-D-0037, Delivery Order 0004 issued by USAED, Mobile and Administered by USAED, Norfolk (Mlecik). The objectives of the project are to research, identify, evaluate, and define energy saving projects that meet the Army's criteria and lead to energy savings at the Letterkenny Depot with respect to lighting. Details of the authorization and objectives of this report, which delineates our contractual arrangement with the government, may be found in Section 9.1.

1.2 Synopsis of Findings

Entech Engineering, Inc. surveyed over 2 million square feet of lighting in defined areas of seventy-two buildings along with the roadway and parking lot areas. Overall, we considered over 14,000 luminaires with an annual estimated operating cost of $330,000. Entech prepared documentation for seventeen (17) Energy Saving Opportunities (ECOs) complete with cost estimates and life cycle cost analysis.

Eight (8) ECO projects are recommended with a total implementation cost of approximately $1,000,000 and an energy savings of 7,300 mmBtu (2,100,000 kWh). The recommended ECOs are listed in Table 1.2.1.

Table 1.2.1
Recommended ECO's
Letterkenny Army Depot

ECO No.	ECO Description	Implementation Cost $	Energy Savings mmBtu	LCCID Simple Payback (Yrs)	LCCID SIR	1ST YR $ SAVINGS
ECO-2	Incandescent Exit Signs to LED Exit Signs	$6,400	61.2	3.03	5.74	2,225
ECO-3	Incandescent Area Light over Paper Exit Sign	$4,600	88.3	1.83	9.54	2,652
ECO-4B	Incandescent Area Lighting Fixture Replacement	$24,000	254.5	2.75	6.33	9,150
ECO-5	HID Lighting	$41,000	531.4	2.88	6.06	14,763
ECO-6	Efficient Fluorescent Lighting Retrofit	$628,000	4607	9.92	1.78	66,493
ECO-11	Industrial Fluorescent to High Pressure Sodium	$261,000	1554	8.83	1.99	30,988
ECO-12	Occupancy Sensors	$2,900	56.9	7.19	2.45	426
ECO-15	Building Exterior Lighting	$7,000	102.4	2.14	8.13	3,444
Total		**$1,000,000**	**7300**			130,141

23-May-95

1.3 Organization of Report

The report consist of three (3) volumes:

Volume 1

Section 1	Executive Summary
Section 2	Methodology
Section 3	Facility Description
Section 4	Billing History
Section 5	Energy Calculations
Section 6	Energy Conservation Opportunities
Section 7	Operation and Maintenance Practices
Section 8	Conclusion

Volume 2

Section 9	Attachments

Volume 3

Section 10	Lighting Survey Field Data

2.0 METHODOLOGY

2.1 Government Requested Data

Copies of the following documents were requested:

- ETL 11103282, Energy Conservation
- TM 58002, Cost Estimates, Military Construction
- AR41515, 1JAN84, Military Construction, Army (MCA)
- Program Development
- The Latest MCP Index
- NIST Handbook 135
- NISTIR-4942-1
- NIST BLCC

The above documents have not been reproduced as part of this report.

In addition to the above procedural documents, Entech, with considerable assistance from the Letterkenny Army Depot, collected pertinent site specific data, including the following:

- Monthly Electric Bills
- System Load Profiles
- Building Operating Schedules
- Previous Energy Studies
- Building Drawings
- Maintenance Issues

2.2 Site Information Collection Procedures

Entech Engineering, Inc. investigated defined areas in seventy-two buildings on a room-by-room basis along with the roadway and parking lot areas during November and December 1994. A walk-through inspection was performed for each building in the study group. The roadway and parking lot areas were surveyed after dark. Lighting operation was reviewed and pertinent features were inventoried. The Depot personnel furnished the building operation hours and assisted in the roadway and parking lot survey. The following information was recorded during the walk through:

- Room Area or Description
- Ceiling Height (Work Areas Only)
- Luminaire Type in accordance with the U.S. Army Corps of Engineers, Standard No. 40-06-04, February 1991
- Light Levels (Work Areas Only)
- Number of Luminaires
- Lamps per Luminaire
- Watts per Lamp
- Lamp Type

2.3 Lighting Model

Entech used an in-house computer spreadsheet to model the lighting load of each room or area on a per-building basis. A sample of the lighting model used is shown in Table 2.3.1 which can be found at the end of this section. Information from the building walk through was entered into the light model in order to develop a monthly estimate of electric demand,

usage, and cost associated with the building lighting. The lighting model breaks down the costs by room or area. The following is a definition of each column heading in the lighting model:

Room Area or Description

Location of luminaires.

Ceiling Height

The distance from the floor to the ceiling was measured in the field using an Accutape II Ultrasonic Distance Measurement Device.

Luminaire Type, Army #

The luminaires surveyed were matched against the U.S. Army Corps of Engineers, Lighting Fixtures, Standard Detail No. 40-06-04, February 1991. The designation 230V, which is not part of the above publication, is used for vapor tight industrial 1' x 4' fluorescent luminaires. The designation N/A was used for luminaires which were not shown in any form in the above publication.

Luminaire Factor

The luminaire factor adjust the wattage of the luminaires to account for the power consumed by a ballast. The number 1.15 is the ballast factor used for luminaires which incorporate ballasts. The ballast factor is multiplied by the sum of the lamp wattages to obtain the total watts of the luminaire. According to ballast manufacturing data, a conventional magnetic ballast consumes about 15% of the rated lamp wattage. For

example, a two lamp luminaire with F40T12 (40 watt) lamps will consume 92 watts {(40 watts/lamp x 2 lamps) x 1.15}.

Ballasted luminaires include fluorescent, high-pressure sodium, metal halide, and mercury vapor. A ballast factor of one (1) is used for incandescent fixtures because they do not require ballast.

Light Levels

The room or area light levels were measured using Photo Meter Model #1, Digital Footlamber Meter held roughly 30" above the finished floor. The levels listed represent an averaging of the levels found directly below the luminaires and positions around the luminaires. Measurements in areas where the lighting fixtures appeared to be less than fully operational (burnt lamps, failing ballasts, damaged lenses) were avoided wherever possible. Light levels were taken in working areas only and not in restrooms or storage areas. Where switching configurations allowed different lighting levels, the configuration found was considered the baseline for the report.

Number of Luminaires

Quantity of luminaires found in the room or area. Luminaires used only for emergency lighting are not included. Only permanent luminaires were counted.

Lamps per Luminaire

Quantity of lamps per luminaire.

Watts per Lamp

The rated power consumption per lamp or bulb. (Ballast consumption not included.) The lamp types were not individually inventoried. Lamps in use were assumed to be consistent within a space or group of similar spaces. The actual lamp was determined either by the information extracted from the installation drawings, actual field inspection, inventory of replacement stock, review of maintenance records, or a combination of the above.

Lamp Type

Type of lamp for each luminaire is abbreviated as follows:

F	—	Fluorescent
HPS	—	High-Pressure Sodium
I	—	Incandescent
MV	—	Mercury Vapor

Total Watts

Total watts for the lighting system.

The total watts were calculated by multiplying the (Luminaire Factor) x (# of Luminaires) x (Lamps per Luminaire) x (Watts per Lamp).

Hours Per Week

The overall weekly building operation hours were estimated by the Depot energy engineer. This data was used in conjunction with our field observations to develop Table 2.3.2, which can be found at the end of this section. Table 2.3.2 is a summary of estimated hours of operation by area.

Percent of kW On-Peak

The percent of kW on-peak is an assumption of the probability of the lighting load attributing to the peak demand. The assumption was based on Entech's review of the furnished building operation data and system load profiles.

Demand kW On-Peak

Calculated by multiplying (Total Watts) x (Percent of kW On-Peak)/(1,000 Watts/kW).

Usage kWh per Month

Calculated by multiplying (Total Watts) x (Hours per Week) x (4.34 Weeks per Month)/(1,000 Watts/kW).

Monthly Demand Cost (kW)

Calculated by multiplying demand kW on-peak by the incremental rate for demand shown at the bottom of the lighting model. The incremental rate calculation is discussed in Section 4 of this report.

Monthly Usage Cost (kWh)

Calculated by multiplying usage kWh per month by the incremental rate for usage shown at the bottom of the lighting model. The incremental rate calculation is discussed in Section 4 of this report.

Monthly Cost

Calculated by summing of the monthly demand and monthly usage cost.

Sample Lighting Model
Letterkenny Army Depot
Building #
Table 2.3.1

Room Area or Description	Ceiling Height Ft	Luminaire Type Army #	Luminaire Factor	Light Levels Meas (FC)	# Of Luminaires	Lamps Per Luminaire	Watts Per Lamp	Lamp Type	Total Watts	Hours Per Week	Percent Of Kw On-Peak	Demand Kw On-Peak	Usage Kwh Per Month	Monthly Demand (Kw)	Monthly Usage (Kwh)	Monthly Cost $

INCREMENTAL DEMAND COST $/KW =
INCREMENTAL USAGE COST $/KWH =

NOTE #1: LUMINAIRE FACTOR: FOR BALLASTED FIXTURES, A BALLAST FACTOR OF 1.15 IS USED AND FOR INCANDESCENT FIXTURES A FACTOR OF 1 IS USED.

NOTE #2: LAMP TYPE:
F = FLUORESCENT
HPS = HIGH PRESSURE SODIUM
I = INCANDESCENT
MV = MERCURY VAPOR

NOTE #3: LUMINAIRE TYPE ARMY #: U.S. ARMY CORPS OF ENGINEERS, LIGHTING FIXTURES, STANDARD DETAIL NO. 40-06-04, FEBRUARY 1991.

TABLE 2.3.2

AREA OPERATION HOURS

■ Roadway and Parking Lot Lighting	80 Hours/Week
■ General Office Areas	100% Building Operation
■ Corridors and Lobbies	100% Building Operation
■ Conference Rooms	70% Building Operation
■ Restrooms	60% Building Operation
■ Janitors Closet	5 Hours/Week
■ Fan and Mechanical Rooms	5 Hours/Week
■ Supply and Storage Rooms	10 Hours/Week
■ Exit Signs	168 Hours/Week
■ Exterior Building Lighting Attached (determined to be inactive)	0 Hours/Week
■ Exterior Building Lighting Attached (determined to be active)	80 Hours/Week
■ Building 412	50 Hours/Week
■ Building 637	40 Hours/Week
■ Building 640	50 Hours/Week/20 Weeks Average 20 Hours/Week/Year

2.4 Lighting Level Standards

The recommended light levels, indicated in Table 2.4.1 on the following page, were extracted from the Illuminating Engineering Society (IES) Lighting handbook except as modified by Chapter 12 of CEMP-E, 9 December 1991. This table shows recommended light levels in footcandles for various generic areas. These values were compared with the levels recorded during the energy audit and were reviewed by representatives of the Depot to determine if areas with excessive lighting levels could contribute to energy savings by a reduction in those lighting levels.

Where lighting levels were below the recommended standard and/or the Depot's needs, this report did not assume additional lighting would be added as we considered energy saving opportunities.

TABLE 2.4.1

IES LIGHT LEVEL RECOMMENDATIONS

Area/Activity	Recommended Light Level
Classrooms	50 - 100 fc
Locker Rooms	10 - 20 fc
Machine Shop	50 - 100 fc
Print Shops	50 - 100 fc
Auditorium (Assembly)	20 - 50 fc
Conference Room	20 - 50 fc
Drafting Room	50 - 100 fc
Kitchens	50 - 100 fc
Dining Areas	10 - 20 fc
Offices	50 - 100 fc
Library Reading Area	50 - 100 fc
Library Stack Area	20 - 50 fc
Computer Rooms	20 - 50 fc
Recreation Rooms	10 - 50 fc
Storage Rooms	10 - 20 fc
Bathrooms	10 - 20 fc
Stairways and Corridors	10 - 20 fc
Lobbies	10 - 20 fc
Building Entrances	5 fc
Gymnasium	30 fc

2.5 Electric Model

Entech's electric model is a computer spreadsheet used to identify the individual building electric loads contribution to demand, usage, and cost. This study analyzed only lighting loads. The electric model summarizes the data compiled in the lighting models.

A sample electric model is shown in Figure 2.5.1 which can be found at the end of this section. The following is a definition of each column heading in the electric model:

Description

Building number or area for which data was collected.

Study Area

Approximate survey square footage of the building.

Connected Load

The total connected electric load, expressed in kW, is shown for both the heating season and the cooling season. Since this study dealt with lighting only, the connected load is constant.

Winter Demand, Intermediate Demand, and Summer Demand

The average kW contributing to the billing demand for each period. Winter months include December, January, February, and March. Intermediate months include April, May, October, and November.

Summer months include June, July, August, and September. Since this study dealt with lighting only, the demand kW was the same for each period.

Winter Usage, Intermediate Usage, and Summer Usage

The usage data is directly from the building lighting models. Again, since the study dealt only with lighting the usage was constant.

Annual Demand

Calculated by multiplying (Winter Demand) x (4 Months) + (Intermediate Demand) x (4 Months) + (Summer Demand) x (4 Months).

Annual Usage

Calculated by multiplying (Winter Usage) x (4 Months) + (Intermediate Demand) x (4 Months) + (Summer Usage) x (4 Months).

Annual Cost

Calculated by summing the annual demand and annual usage costs.

Study Area $/sf

Calculated by dividing the annual cost by the study area.

Letterkenny Army Depot

Sample Depot Electric Model Summary

Table 2.5.1

No.	Description	Study Area	Connected Load (kW)		Winter Demand kW/Mo	Inter Demand kW/Mo	Summer Demand kW/Mo	Winter Usage kWh/Mo	Inter Usage kWh/Mo	Summer Usage kWh/Mo	Annual Demand kW/yr	Annual Usage Kwh/yr	Annual Cost $/yr	Study Area $/sf	No.
			Heating	Cooling											

2.6 Energy Value

The following energy value has been used in the energy calculations in this report. The value has been established by the Pennsylvania Energy Office.

TABLE 2.6.1
mmBtu/Unit

Fuel Type	mmBtu/Unit
Electricity (kWh)	3,413

2.7 Energy Conservation Opportunities (ECOs)

After the lighting models were finalized, Entech began to analyze the ECO ideas which were developed during the site inspection. An ECO describes an idea for decreasing energy costs. Each ECO evaluates a current luminaire or group of luminaires throughout the entire building survey group. The write up consists of the following sections:

1. Existing Condition Description
2. Proposed Condition Description
3. Implementation Cost Estimate
4. Energy Savings
5. Maintenance Savings
6. Discussion
7. Life Cycle Cost Analysis Summary
8. Spreadsheet Detailing Items 1 through 4

2.7.1 Existing Condition Description

The item under evaluation is discussed. Its current specifications and operating hours are reviewed along with a summary of the item's electric demand, usage, and cost from the ECO spreadsheet discussed in Section 2.7.8.

2.7.2 Proposed Condition Description

This section presents the proposed concept to save energy. Since it is a concept, no actual design has been performed. The quantity of luminaires for the proposed system is determined by matching the existing and proposed total area lamp lumen output. First, the existing and proposed lamp lumen output is obtained from published lamp manufacturer data. The proposed system luminaire/lamp quantity is then determined by dividing the existing lumens by the proposed lamp lumens. The proposed lamp wattage and corresponding lumen output is selected based on a conceptual review of the area's physical and functional characteristics.

The proposed lighting system incorporates existing system functions such as emergency lighting only if they currently exist. Once the ECO progresses to the design phase, the design engineer will need to take into detailed account the activity in the space, characteristics of the visual task performed in the space, the age of the occupants, along with current codes and standards.

2.7.3 Implementation Cost Estimate

The estimated cost for implementing the project. The cost estimates are broken down into material, labor, and engineering components. The cost figures are based on manufacturer furnished quotes and/or Means Electrical Cost Data 1995, 18th annual edition.

The cost estimates prepared for this study are considered to be "conceptual" in nature. They are conceptual because they are based upon engineering design that is less than 1% of a complete detailed design effort required for such a project.
The final results of a project can vary significantly from the "conceptual" cost estimate. The American Association of Cost Engineers (AACE) generally states an accuracy range of plus or minus 20% for "conceptual" cost estimates. Variations beyond this range are possible for the stated scope, but not likely.

Since it is not possible for the consultants to know the most likely variations that can occur in the future, nor can it control certain technologies, contractors, or general economic conditions, the costs estimated herein should not be construed as fixed or precise.

2.7.4 Energy Savings

This section of the ECO write up compares the existing and proposed energy demand, usage, and cost. The resulting energy usage savings in mmBtu/yr is calculated. The savings shown is an expected level of annual savings which does not include price increases of various energy sources or takes into account any interactive savings. The ECOs are calculated on a stand-alone basis.

2.7.5 Maintenance Savings

This section presents the proposed maintenance resulting from implementing the ECO. Typically, the existing and proposed lamp and/or luminaire life are quantitatively discussed.

2.7.6 Discussion

The discussion section includes the payback and savings to investment ratio from the Life Cycle Cost Analysis Summary.

2.7.7 Life Cycle Cost Analysis Summary

The life cycle cost were forecasted with the Blast: LCCID version 1.0, Level 80 Program. LCCID is an economic analysis computer program tailored to the needs of the Department of Defense (DoD). It is intended to be used as a tool in evaluation and ranking design alternatives for new and existing buildings. LCCID has built-in calculation procedures recognized as a standard for the DoD. The following is the specific criteria and other guidance embodied in LCCID according to the LCCID users manual.

The specific criteria and other guidance embodied in LCCID are:

1. Office of Management and Budget (OMBP Circular A-94, March 27, 1972. OMB Circular A-94 has a new version (October 29, 1992) but a final decision on incorporating the new circular into tri-service criteria has not been determined.

2. Code of Federal Regulations, 10 CFR 436A, January 25, 1990. Annual fuel escalation rates are published by NIST (National Institute of Standards and Technology) under sanction by DoE.

3. Memorandum of Agreement on Criteria/Standards for Economic Analysis/Life Cycle Costing for MILCON Design, 18 March 1991. This memorandum obviated the need for separate criteria in the three services (Army, Air Force, and Navy) of the Department of Defense.

4. DoD Energy Conservation Investment Program (ECIP) Guidance. This guidance uses the memorandum from Item 3, as its basis, but also has some qualifying factors for energy conservation projects and specifies its own format.

The LCCID Program is structured as shown on Table 2.7.7.1, ECIP Study LCCID Ready Reference, which can be found at the end of this section. This table was obtained from the LCCID program users manual.

The following criteria was selected/entered into the LCCID program to obtain the Life Cycle Cost Analysis Summaries prepared as part of each ECO:

A. Common criteria selected for all life cycle cost analysis summaries:

- Military Construction Army
- User Entry of Consumption Values
- ECIP Project
- Energy Escalation Rates for FY94 (only option available)
- English Units

B. Common criteria entered into all life cycle cost analysis summaries:

- ECIP Economic Life: Twenty-five years per direction of Letterkenny Army Depot
- Location: Pennsylvania

— Electric Usage Cost: $7.27 per mmBtu

$$\left(\frac{.0248}{kWh} \times \frac{kWh}{3{,}413\ Btu} \times \frac{1 \times 10^{6}\ Btu}{mmBtu}\right)$$

— Project Number: #4130.01

— Fiscal Year: 1995

— Project Title: EEAP

— Installation Name: Letterkenny Army Depot

— Study Preparer:

DJB

— Salvage Value: $0, per direction of Letterkenny Army Depot.

C. Criteria entered into life cycle cost analysis summaries from the ECO:

— Discrete Portion Title: ECO #

— Construction Cost: Dollars

— Design Cost: Dollars

— Supervision, Inspection, and Overhead (SIOH): Program default of 5.5% of construction cost

— Energy Savings: mmBtu

— Demand Savings: Annual Dollars

— Annual Recurring Savings: Maintenance Savings ECO Section

— Non-Recurring Savings: Maintenance Savings ECO Section

A sample Life Cycle Cost Analysis Summary Report is shown in Table 2.7.7.2 located at the end of this section. In this example, all the common criteria noted in 2.7.7 Items A and B, was selected or entered into this summary report.

In Part 1 of the summary report, a construction cost of $10,000 and a design cost of $1,200 was assumed. The SIOH was calculated by the program.

In Part 2 of the summary report, an electric energy saving of 500 mmBtu/yr was assumed. A $500/yr demand savings shown in "2 M" was also assumed.

In Part 3 of the summary report, a maintenance savings of $100/yr was also assumed. In the actual summary report, the above-assumed numbers would originate from an ECO. In the example, the program calculated a simple payback of 2.77 years and a savings to investment ratio of 6.50.

ECIP STUDY - LCCID READY REFERENCE

Table [redacted]1

HELP or @ - To SHOW why the question pertains to LCC and to get hints on allowable answers.
LIST or ? - To DISPLAY a LIST of allowable inputs.
TEACH - To begin seeing all the help messages before entering your response.
SAVE - To save the Study File from any prompt.
ABORT or QUIT - To TERMINATE the program without saving any information since the last SAVE or Auto-save.

MAIN MENU CH[redacted]
S = Select Study Par[redacted]s
A = Define / Change Discrete Portions
C = Calculate & Report Life Cycle Costs
N = Select Next Study
D = Change Directory of Study/Report Files
<cr> = exit PROGRAM

S

SELECT STUDY PARAMETER Choices
C = Select Criteria for Present Worth Calculations
D = Select Key Study Dates
M = Select Dollar Input Multiplier
E = Select Energy Related Study Inputs
T = Select Study Identification Block
<cr> = exit SELECT STUDY PARAMETERS

D

SELECT KEY STUDY DATES Choices
L = Economic Life of Building
<cr> = exit SELECT KEY STUDY DATES

E

SELECT ENERGY RELATED STUDY INPUT Choices
S = Select Location (Region for E-Values)
U = Select Energy Input Units
P = Select Energy Prices
<cr> = exit SELECT ENERGY RELATED STUDY INPUT

P

SELECT ENERGY PRICES Choices
0 = Initialize All Energy Type Prices
1 = Select Prices of ELECT
2 = Select Prices of DIST
3 = Select Prices of RESID
4 = Select Prices of NAT G
5 = Select Prices of COAL
6 = Select Prices of LPG
7 = Select Prices of SOLAR
8 = Select Prices of GEOTH
9 = Select Prices of BIOMA
10 = Select Prices of REFUS
11 = Select Prices of WIND
12 = Select Prices of OTHER
<cr> exit SELECT ENERGY PRICES

T

SELECT STUDY IDENTIFICATION BLOCK Choices
I = Re-enter All Study Identification Block Data
T = Specify Project Title
L = Specify Installation Name
P = Specify Project Number
F = Specify Fiscal Year
A = Specify Name of Analyst
<cr> = exit SELECT STUDY IDENTIFICATION BLOCK

C

CALCULATE & REPORT LIFE CYCLE COSTS Choices
I = Generate ECIP Summary Reports
<cr> = exit CALCULATE & REPORT LIFE CYCLE COSTS

A

DEFINE / CHANGE DISCRETE PORTIONS Choices
L = List Discrete Portion Titles
S = Define / Change Discrete Portion Values
D = Delete Discrete Portions
R = Resequence Discrete Portion Identifiers
O = Put Discrete Portion Identifiers in Ascending Order
<cr> = exit DEFINE / CHANGE DISCRETE PORTIONS

S

DEFINE / CHANGE Discrete Portion Values
V = Specify Construction, SIOH, and Design Costs
E = Specify Energy Usage Savings
S = Specify Salvage Value of Existing Equipment
U = Specify Public Utility Rebate
M = Specify Annually Recurring Savings/Costs
R = Specify Non Recurring Savings/Costs
L = List this Discrete Portion's Identifier and Title
D = Delete this Discrete Portion
<cr> = exit DEFINE / CHANGE Discrete Portion Values

E

SELECT ENERGY PRICES Choices
0 = Initialize All Energy Type Prices
1 = Select Prices of ELECT
2 = Select Prices of DIST
3 = Select Prices of RESID
4 = Select Prices of NAT G
5 = Select Prices of COAL
6 = Select Prices of LPG
7 = Select Prices of SOLAR
8 = Select Prices of GEOTH
9 = Select Prices of BIOMA
10 = Select Prices of REFUS
11 = Select Prices of WIND
12 = Select Prices of OTHER
<cr> exit SELECT ENERGY PRICES

V

INVESTMENT COSTS Choices
I = Initialize All Investment Costs for this Discrete Portion
C = Specify Construction Cost and Related Information
D = Specify Design Cost and Related Information
O = Specify SIOH Cost and Related Information
<cr> = exit INVESTMENT COSTS

M

SPECIFY ANNUAL VALUES Choices
L = List Annual Values by Title
S = Define / Change Annual Values
D = Delete an Annual Value
<cr> = exit SPECIFY ANNUAL VALUES

R

SPECIFY ONE-TIME VALUES Choices
L = List One-time Values by Title
S = Define / Change One-time Values
D = Delete an One-time Value
<cr> = exit SPECIFY ONE-TIME VALUES

Table 2.7.7.2

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: SAMPLE
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.080
INSTALLATION & LOCATION: LETTERKENNY REGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: 4130.01 EEAP
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO #
ANALYSIS DATE: 04-18-95 ECONOMIC LIFE 25 YEARS PREPARED BY: DJB

1. INVESTMENT

A. CONSTRUCTION COST	$ 10000.	
B. SIOH	$ 550.	
C. DESIGN COST	$ 1200.	
D. TOTAL COST (1A+1B+1C)	$ 11750.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.	
F. PUBLIC UTILITY COMPANY REBATE	$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 11750.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.27	500.	$ 3635.	18.17	$ 66048.
B. DIST	$ .00	0.	$ 0.	20.83	$ 0.
C. RESID	$ .00	0.	$ 0.	23.76	$ 0.
D. NAT G	$ .00	0.	$ 0.	22.78	$ 0.
E. COAL	$ .00	0.	$ 0.	20.78	$ 0.
F. LPG	$ .00	0.	$ 0.	18.87	$ 0.
M. DEMAND SAVINGS			$ 500.	17.22	$ 8610.
N. TOTAL		500.	$ 4135.		$ 74658.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 100.
(1) DISCOUNT FACTOR (TABLE A)	17.22	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 1722.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)	$ 1722.
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))	$ 4235.
5. SIMPLE PAYBACK PERIOD (1G/4)	2.77 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	$ 76380.
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)=	6.50
(IF < 1 PROJECT DOES NOT QUALIFY)	
8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	11.12 %

2.7.8 Spreadsheet Detailing Items 2.7.1 through 2.7.4

Table 2.7.8.1 is a sample spreadsheet, located on the following page, which was developed for each ECO to quantitavely discuss the existing condition, proposed condition, implementation cost, and resulting energy savings. The data for the existing condition portion of the ECO spreadsheet was copied from the lighting models. The proposed condition and implementation cost are as discussed in Sections 2.7.2 and 2.7.3 respectively. The energy savings is the energy cost difference between the existing and proposed condition.

Table 2.7.8.1
ECO-#
Letterkenny Army Depot
Sample ECO Spreadsheet

Existing												*Proposed*					*Implementation*				
Room	NO. Of Luminaires	Lamps Per Luminaire	Watts Per Lamp	Total Watts	Hours Per Week	Percent Of Kw On Peak	Demand Kw On Peak	Usage Kwh Per Month	Annual Demand (Kw)	Annual Usage (Kwh)	Annual Cost $	New Luminaire Description	Watts Per Luminaire	Proposed Demand (Kw)	Proposed Kwh Per Month	Annual Cost $	Mat. Cost $	Labor Cost $	Eng Cost $	Total Cost $	Energy Savings $

G:\PROJECTS\4130.01\SS\ECO\SAMPLE.WK4

24-Aug-95

2.8 Draft Report/Client Review/Final Report

After the previous sections have been substantially completed, Entech compiles the information into the report format. Entech then schedules a meeting with the client to present its findings. A copy of the report is supplied to the client for a more detailed review.

Entech will then incorporate the clients review comments and produce a final report.

3.0 FACILITY DESCRIPTION

3.1 General

The Letterkenny Army Depot is located in central Pennsylvania about five miles north of Chambersburg. The Depot was constructed in 1942 during World War II for ammunition storage and tank maintenance. The facility covers over 20,000 acres of land and includes 1,400 permanent buildings. A partial Depot map is shown in Figure 3.1.1 located at the end of this section.

3.2 Survey Areas

The Energy Engineering Analysis Program (EEAP) Lighting Study for Letterkenny Army Depot was authorized by U.S. Army Engineering District, Mobile. The lighting study evaluated seventy-two buildings totalling over 2 million square feet along with the Depot roadway and parking lot lighting. Over 14,000 luminaires were surveyed.

The surveyed building areas were typically either administration, maintenance/testing, warehouse, recreational, or personnel housing. The administration areas include office areas and computer rooms. Fluorescent lighting was predominate in the administration areas. The maintenance/testing areas consisted of electronic repair, vehicle repair, trade shops, and laboratory areas. These areas contained fluorescent, incandescent, and HID lighting. The warehouse areas included bulk storage as well as secondary item storage and distribution. HID lighting was typically found in these areas.

The recreation areas included the gym, day care, and youth center. These areas typically contain both fluorescent and incandescent lighting. Only two (2) personnel housing areas were surveyed, Buildings 417 and 418. These buildings were found to contain fluorescent lighting.

The roadway and parking lot areas were surveyed in the evening with the assistance of the Depot energy engineer. Typically, pole-mounted, high-pressure sodium, or mercury vapor lamps were found.

3.3 Operation Schedule

The building operation hours were furnished by the Depot energy engineer and are shown in Table 3.3.1 located at the end of this section.

Figure 3.1.1

Depot Map

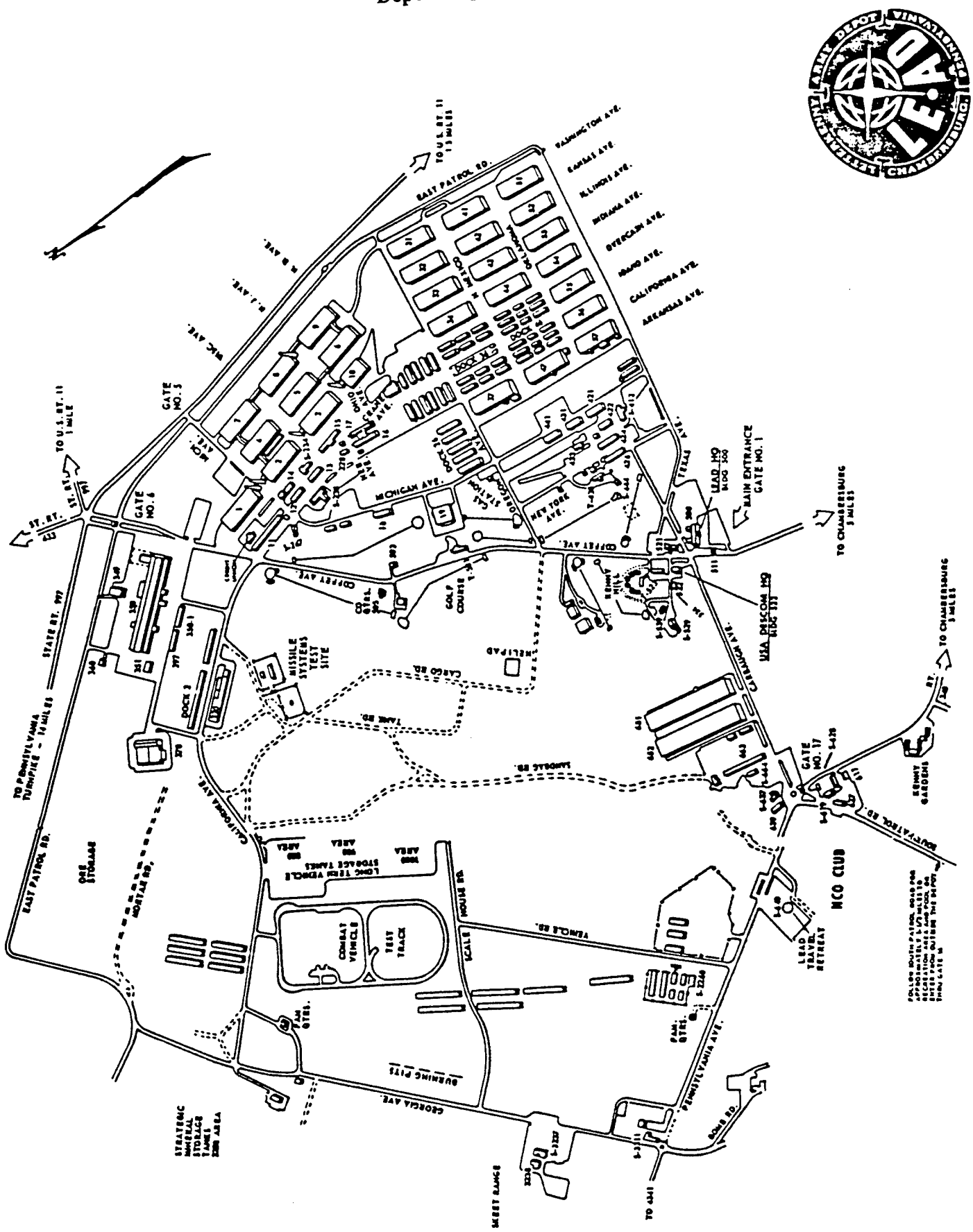


Table 3.3.1
Building Operation Schedule

BUILDING	DAYS PER WEEK			HOURS PER DAY			
	5	7	other	10	18	24	other
1							
2-S							
3		COMPUTER (2)				COMPUTER (2)	
4							
5							
6							
10		COMPUTER (2)				COMPUTER (2)	
14							
19							
20-1							
31							
32							
33-N							
34							
37							
41							
42-S							
43							
44							
47							
51							
52							
53							
54							
55							
57							
102							
198							
199							
200							
211							
247							
320							
349							
350							
370							
412							
416							
417							BARRACKS (2)
418							BARRACKS (2)
421							
424							
428							
431							
438							
441							
500						SECURITY (2)	
521							
522							
523							

Table 3.3.1
Building Operation Schedule

BUILDING	DAYS PER WEEK			HOURS PER DAY			
	5	7	other	10	18	24	other
524							
529			CLUB				CLUB (2)
530							
536		3			3		
581							
616							
618							
619							
628							
629							
637			4				4
639							
640							
645							
646							
663							
664							
2260							
2268							
2329							
2755							
3311							
3315							
3321							
5425							

NOTES:

1.) Schedules illustrated above were furnished by the LEAD, Energy Program Coordinator. The facility was defined as operating if 75% of the fixtures were energized.

2.) Portions of the Building are on different schedules.

3.) Seasonal use only – (Bath House)

4.) Chapel with intermittant schedule.

4.0 BILLING HISTORY

4.1 General

The electric energy analysis for this report is based upon electric billing data from October 1992 through June 1994.

Currently, the Letterkenny Army Depot is installing a new electrical distribution system and substation. As the electric distribution system is being upgraded, the load from the existing substation is being transferred to the new substation. The Depot therefore currently has two services from the West Penn Power Company. In the near future the entire Depot load will be transferred to the new substation. The existing substation will then be abandoned.

4.2 Electricity

West Penn Power Company provides power to Letterkenny Army Depot under Schedule 40 primary power service. Copies of the rate schedule and electric bills are located in Section 9.3.

The Depot electric billing history for the period between October 1992 and June 1994 is summarized in Table 4.2.1. The billing history for the two electric services is shown in Tables 4.2.2 and 4.2.3. The monthly demand (kW), usage (kWh), and cost for the tables have been extracted from the actual electric bills.

LETTERKENNY ARMY DEPOT
BASE ELECTRIC BILLING HISTORY
1993 - 1994, SUMMARY
TABLE 4.2.1

1993 - 1994

Month	# of Days	Billed kW	kvar	Total kWh	Cost $	$/kWh	Energy mmBtu	kWh Per Day
July	30	11,795	758	4,910,342	$227,684	$0.046	16,759	163,678
August	30	11,557	739	5,151,836	$232,732	$0.045	17,583	171,728
September	30	11,484	732	4,823,757	$222,636	$0.046	16,463	160,792
October	30	10,695	642	4,274,674	$202,072	$0.047	14,589	142,489
November	30	9,908	603	4,255,701	$185,456	$0.044	14,525	141,857
December	30	10,264	583	4,217,114	$186,802	$0.044	14,393	140,570
January	30	10,370	572	4,275,201	$189,033	$0.044	14,591	142,507
February	32	10,371	516	4,584,279	$196,660	$0.043	15,646	143,259
March	28	10,295	524	4,053,069	$182,991	$0.045	13,833	144,752
April	31	10,466	826	4,602,371	$198,749	$0.043	15,708	148,464
May	31	10,588	1,099	4,486,063	$199,043	$0.044	15,311	144,712
June	30	11,736	1,173	4,649,194	$211,744	$0.046	15,868	154,973
TOTALS	362	129,529	8,767	54,283,601	$2,435,603	$0.045	185,270	149,955

1992 - 1993

Month	# of Days	Billed kW	kvar	Total kWh	Cost $	$/kWh	Energy mmBtu	kWh Per Day
July								
August								
September								
October	30	10,907	0	3,752,364	$163,719	$0.044	12,807	125,079
November	30	10,102	0	4,477,161	$175,672	$0.039	15,281	149,239
December	30	10,231	0	4,245,054	$171,090	$0.040	14,488	141,502
January	30	10,417	0	4,158,081	$170,319	$0.041	14,192	138,603
February	30	10,347	0	4,728,461	$183,294	$0.039	16,138	157,615
March	30	10,406	0	4,022,569	$166,955	$0.042	13,729	134,086
April	31	12,115	418	4,522,632	$188,026	$0.042	15,436	145,891
May	30	10,399	689	4,294,804	$189,124	$0.044	14,658	143,160
June	32	10,999	776	4,660,576	$214,441	$0.046	15,907	145,643
TOTALS	273	95,923	1,883	38,861,702	$1,622,638	$0.042	132,635	142,351

LETTERKENNY ARMY DEPOT
BASE ELECTRIC BILLING HISTORY
1993 - 1994, RATE 401, ACCOUNT #41/22/000/11205/1
NEW SUBSTATION
TABLE 4.2.2

1993 - 1994

Month	# of Days	Billed kW	kvar	Total kWh	Cost $	$/kWh	Energy mmBtu	kWh Per Day
July	30	3,391	758	1,833,600	$88,465	$0.048	6,258	61,120
August	30	3,363	739	1,891,200	$90,492	$0.048	6,455	63,040
September	30	3,383	732	1,785,600	$86,628	$0.049	6,094	59,520
October	30	3,210	642	1,660,800	$81,205	$0.049	5,668	55,360
November	30	3,180	603	1,680,000	$70,796	$0.042	5,734	56,000
December	30	3,093	583	1,593,600	$68,026	$0.043	5,439	53,120
January	30	2,955	572	1,536,000	$65,564	$0.043	5,242	51,200
February	32	2,886	516	1,574,400	$65,940	$0.042	5,373	49,200
March	28	3,007	524	1,459,200	$64,085	$0.044	4,980	52,114
April	31	3,283	826	1,766,400	$74,085	$0.042	6,029	56,981
May	31	4,044	1,099	1,920,000	$84,696	$0.044	6,553	61,935
June	30	4,147	1,173	2,006,400	$87,665	$0.044	6,848	66,880
TOTALS	362	39,942	8,767	20,707,200	$927,647	$0.045	70,674	57,202

1992 - 1993

Month	# of Days	Billed kW	kvar	Total kWh	Cost $	$/kWh	Energy mmBtu	kWh Per Day
July								
August								
September								
October								
November								
December								
January								
February								
March								
April	11	1,884	418	422,400	$19,736	$0.047	1,442	38,400
May	30	2,333	689	1,392,000	$64,117	$0.046	4,751	46,400
June	32	3,142	776	1,766,400	$84,506	$0.048	6,029	55,200
TOTALS	73	7,359	1,883	3,580,800	$168,358	$0.047	12,221	49,052

Note: Electric rate changes from 301 to 401 during October 1993

LETTERKENNY ARMY DEPOT
BASE ELECTRIC BILLING HISTORY
1993 - 1994, RATE 401, ACCOUNT # 41/22/000/11200/1
OLD SUBSTATION
TABLE 4.2.3

1993 - 1994

Month	# of Days	Billed kW	kvar	Total kWh	Cost $	$/kWh	Energy mmBtu	kWh Per Day
July	30	8,404	0	3,076,742	$139,218	$0.045	10,501	102,558
August	30	8,194	0	3,260,636	$142,240	$0.044	11,129	108,688
September	30	8,101	0	3,038,157	$136,008	$0.045	10,369	101,272
October	30	7,485	0	2,613,874	$120,867	$0.046	8,921	87,129
November	30	6,728	0	2,575,701	$114,660	$0.045	8,791	85,857
December	30	7,171	0	2,623,514	$118,776	$0.045	8,954	87,450
January	30	7,415	0	2,739,201	$123,469	$0.045	9,349	91,307
February	32	7,485	0	3,009,879	$130,720	$0.043	10,273	94,059
March	28	7,288	0	2,593,869	$118,906	$0.046	8,853	92,638
April	31	7,183	0	2,835,971	$124,664	$0.044	9,679	91,483
May	31	6,544	0	2,566,063	$114,347	$0.045	8,758	82,776
June	30	7,589	0	2,642,794	$124,079	$0.047	9,020	88,093
TOTALS	362	89,587	0	33,576,401	$1,507,956	$0.045	114,596	92,752

1992 - 1993

Month	# of Days	Billed kW	kvar	Total kWh	Cost $	$/kWh	Energy mmBtu	kWh Per Day
July								
August								
September								
October	30	10,907	0	3,752,364	$163,719	$0.044	12,807	125,079
November	30	10,102	0	4,477,161	$175,672	$0.039	15,281	149,239
December	30	10,231	0	4,245,054	$171,090	$0.040	14,488	141,502
January	30	10,417	0	4,158,081	$170,319	$0.041	14,192	138,603
February	30	10,347	0	4,728,461	$183,294	$0.039	16,138	157,615
March	30	10,406	0	4,022,569	$166,955	$0.042	13,729	134,086
April	31	10,231	0	4,100,232	$168,290	$0.041	13,994	132,266
May	30	8,066	0	2,902,804	$125,007	$0.043	9,907	96,760
June	32	7,857	0	2,894,176	$129,935	$0.045	9,878	90,443
TOTALS	273	88,564	0	35,280,902	$1,454,280	$0.041	120,414	129,234

4.2.1 Incremental Cost

Entech Engineering, Inc. has developed a Lotus 123 spreadsheet to duplicate a client's electric bill and determine the incremental cost for electricity.

First, the most recent electric bill is obtained from the client. At Letterkenny Army Depot the August 15 - September 15, 1994 billing period was used. This billing data is shown in Table 4.2.1.1 located at the end of this section. The usage (kWh), demand (kW), and reactive demand (kVar) values were extracted from the bill and used as input into the spreadsheet. The taxes and other special adjustments are also entered into the spreadsheet.

The duplicate electric bill for the above-stated period is then calculated and compared to the actual bill. Table 4.2.1.2 indicates the current period charges to be $88,880.91, which matches the actual electric bill which is shown in Table 4.2.1.4. Both tables are located at the end of this section.

Table 4.2.1.3 indicates how the incremental costs were calculated. The incremental usage cost is calculated by taking the actual billing, on-peak usage (2,092,800 kWh), subtracting one kWh, and recalculating the electric bill. The difference in the actual billing cost and the cost for one less kWh is the incremental usage cost.

The same procedure is performed to determine the incremental demand cost. For this facility, the incremental costs for electricity are as follows:

- Incremental Usage Cost $/kWh = $0.0248
- Incremental Demand Cost $/kW = $7.706

The incremental costs are used in the lighting models to determine the electric cost associated with each area. The incremental costs are also used in the ECOs to determine the electric cost of the proposed energy savings projects.

The use of incremental rates is reasonably accurate for calculating cost savings for small changes in demand and usage ($\pm 25\%$ from existing levels). The use of incremental rates is less accurate in calculating cost savings with larger changes in demand and usage ($>25\%$) and tends to underestimate savings slighting (usually less than 2%). However, for the convenience of calculating the feasibility of various options, the use of incremental rates for demand and usage is either accurate to slightly conservative (savings not overestimated) and therefore prudent.

Table 4.2.1.1

West Penn Power Company, Rate 401 (Primary Power), Electric Rate Analysis

Prepared by Entech Engineering, Inc.

Billing and Client Information

Client	Letterkenny Army Depot, Account #11205
Billing Year	1994
Billing Period	August
# of Billing Days	31

Demand and Usage Information

Supply Voltage	13,200
Demand Measurements	
On-Peak Demand (kW)	4,044
Off-Peak Demand (kW)	4,044
Billing Demand (kW)	4,044
Usage Measurements	
On-Peak Period (kWh)	2,092,800
Off-Peak Period (kWh)	0
Power Factor Measurements	
Reactive Demand (kvar)	1,089

Taxes and Special Adjustments

Fuel Adjustments Rate	$0.0023740
Pa State Tax Surcharge	-0.12%
Facilities Charge	$5,199.00

Table 4.2.1.2

West Penn Power Company, Rate 401 (Primary Power) Electric Rate Analysis

Prepared by Entech Engineering, Inc.

Duplicated Electric Bill

Demand Charges				
First 2,000 kW	2,000 kW @	$7.537	Per kW =	$15,074.00
All Other kW	2,044 kW @	$7.439	Per kW =	$15,205.32
Usage Charges				
First 400 Hours of Demand	1,617,600 kWh @	$0.02314	Per kWh =	$37,431.26
All Remaining kWh	475,200 kWh @	$0.02245	Per kWh =	$10,668.24
Power Factor Penalties				
Reactive Demand, kvar	1,089 kvar @	$0.400	Per kvar =	$435.60
Facilities Charge				$5,199.00
Pa Tax Surcharge	(0.12)% x	$84,013.42	Subtotal =	($100.82)
Energy Cost Rate	$0.0023740 $/kWh x	2,092,800	kWh =	$4,968.31
			CURRENT PERIOD CHARGES.	$88,880.91

Calculated Incremental

Incremental Cost Per On-Peak kW	$7.706
Incremental Cost Per Maximum kW	$0.0248

Calculated Billing Statistics Based on Incremental Costs

Demand Cost	$31,162.02	Energy Cost	$51,895.29
% Demand	35.1%	% Energy	58.4%
Load Factor	69.6%	Power Factor Penalty	$442.78

Current Electric Tariff (Rate HT)

First 2,000 kW of Billing Demand, $/kW	$7.537
All Billing Demand Above 2,000 kW, $/kW	$7.439
First 400 Hours Use of Billing Demand, $/kWh	$0.02314
All kWh Over 400 Hours of Use, $/kWh	$0.02245
Reactive Demand (kvar), $/kvar	$0.40

Incremental Cost Check

Bill Calculated Using Incrementals From Above	$83,057.31
Actual Current Period Charges (Less Facilities Charge)	$83,681.91
Cost Variance (Actual Minus Incremental)	$624.60
Percent Variance (Var/Actual)	0.7%

Table 4.2.1.3

West Penn Power Company, Rate 401 (Primary Power Service), Electric Rate Analysis

Prepared by Entech Engineering, Inc.

Electric Bill Calculation

Calculation Description	Actual Billing	Billing Demand Minus 1 kW	Usage Minus 1 kWh	0 kvar
Billing Demand (kW)	4,044	4,043	4,044	4,043
On-Peak Usage (kWh)	2,092,800	2,092,800	2,092,799	2,092,800
Off-Peak Usage (kWh)	0	0	0	0
Total Usage (kWh)	2,092,800	2,092,800	2,092,799	2,092,800
Reactive Demand (kvar)	1,089	1,089	1,089	0
Fuel Adjustment Rate ($/kWh)	$0.0023740	$0.0023740	$0.0023740	$0.0023740
Pa Tax Adjustment (%)	-0.12%	-0.12%	-0.12%	-0.12%
Breakdown Calculations				
Reactive Demand (kvar)	1,089	1,089	1,089	0
Block One Demand (kW), First 2,000	2,000	2,000	2,000	2,000
Block Two Demand (kW), All Other	2,044	2,043	2,044	2,043
Block One Usage (kWh), 400 hrs of Billing Demand	1,617,600	1,617,200	1,617,600	1,617,200
Block Two Usage (kWh), All Other	475,200	475,600	475,199	475,600
Cost Calculation				
Reactive Demand (kvar)	$435.60	$435.60	$435.60	$0.00
Block One Demand (kW), First 2,000	$15,074.00	$15,074.00	$15,074.00	$15,074.00
Block Two Demand (kW), All Other	$15,205.32	$15,197.88	$15,205.32	$15,197.88
Block One Usage (kWh), 400 hrs of Billing Demand	$37,431.26	$37,422.01	$37,431.26	$37,422.01
Block Two Usage (kWh), All Other	$10,668.24	$10,677.22	$10,668.22	$10,677.22
Subtotal	$78,814.42	$78,806.71	$78,814.40	$78,371.11
Facilities Charge	$5,199.00	$5,199.00	$5,199.00	$5,199.00
Subtotal	$84,013.42	$84,005.71	$84,013.40	$83,570.11
Pa State Tax Surcharge	($100.82)	($100.81)	($100.82)	($100.28)
Energy Cost Rate	$4,968.31	$4,968.31	$4,968.30	$4,968.31
Net Current Bill	$88,880.91	$88,873.21	$88,880.89	$88,438.13
Incremental/Penalties	n/a	$7.706	$0.0248	$442.78

SOUTH 7TH STREET
CONNELLSVILLE, PA 15425

Table 4.2.1.4

10/17/94 | 1

USE WHEN REFERRING TO BILL
ACCOUNT NO.
1/41/22/000/112051

Actual Electric Bill

TELEPHONE: (412) 626-5280

MAIL TO:

1/41/22/000/112051
LETTERKENNY ARMY DEPOT

SDSLE-ERW
CHAMBERSBURG PA
17201

WEST PENN POWER COMPANY

PO BOX 640575
PITTSBURGH PA 15264-0575

00000000 9 021914122000112051 08999192 9 08888091 00

WHEN PAYING AT OFFICE OR AGENCY, PLEASE BRING ENTIRE BILL
WHEN PAYING BY MAIL, PLEASE RETURN THIS PORTION OF BILL WITH PAYMENT IN ENCLOSED ENVELOPE

ACCOUNT NUMBER	SERVICE LOCATION	RATE	BILLING DATE
1/41/22/000/112051/1 3		401	09/16/94

ACCOUNT BALANCE 08/16/94	94,843.41	
PAYMENT RECEIVED	94,843.41-	
ACCOUNT BALANCE BROUGHT FORWARD		.00

CURRENT BILLING FOR 031 DAYS USE 08/15/94 TO 09/15/94

METER	A			
CURRENT READING	3218			
PREVIOUS READING	2992			
DIFFERENCE	218			
MULTIPLIER	9600			
KWH	2092800			
KW DEMAND	4044.0			
BILLING DEMAND CHARGE FOR	4,844.0 KW			
2,800.0	@ 7.3370		15,874.86	
2,044.0	@ 7.4390		15,205.32	
ENERGY CHARGE FOR	2,092,800 KWH			
1,617,600	@ .02314		37,431.26	
475,200	@ .02245		10,668.24	
RKVA DEMAND CHARGE				
1,089.0	@ 0.400		435.60	
BILLED CHARGES ON RATE 401				79,814.42
FACILITY CHARGE				5,199.00
PA TAX SURCHARGE @	+.1200000%			100.82-
ENERGY COST RATE @	.0023748 /KWH			4,968.31
CHARGE FOR CURRENT BILL PERIOD				88,880.91
AMOUNT DUE				88,880.91
LATE PAYMENT CHARGE		1,111.01		
TOTAL AMOUNT DUE AFTER	10/17/94	89,991.92		

ESTIMATED PA STATE TAXES OF 6,434.98 INCLUDED IN THIS BILLING

West Penn Power Company
Part of the Allegheny Power System

4.2.2 Electric Usage

Electric usage is measured in kilowatt hours (kWh). One kWh is equivalent to the usage of 1,000 watts of electricity for one hour. Figure 4.2.2.1 graphically shows electrical usage profile of the Depot for the period of October 1992 through June 1994.

The electric usage appears to peak during the summer months. The annual usage for 1992-93 and 1993-94 is fairly consistent with the exception of the month of October.

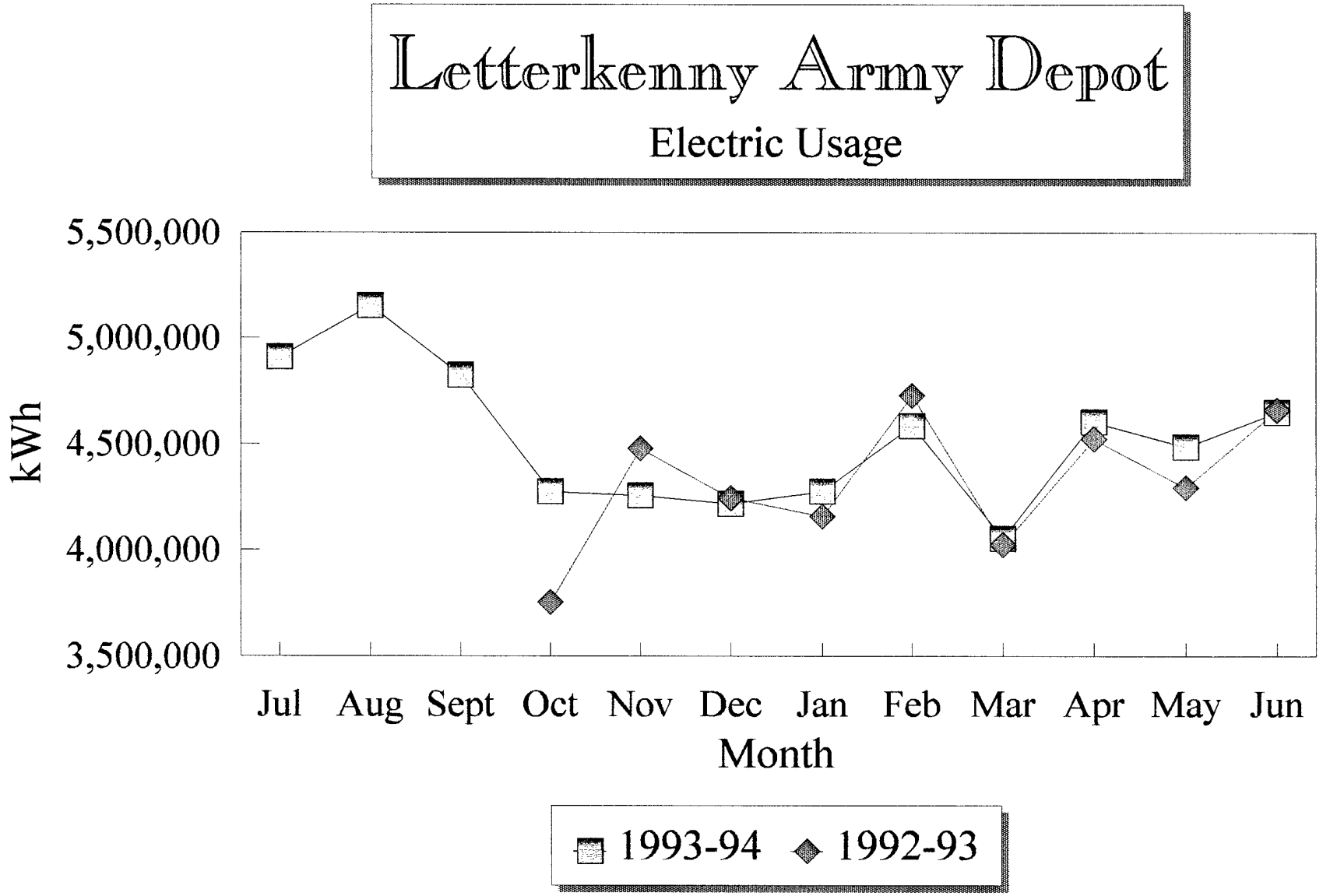

Letterkenny Army Depot
Electric Usage
5,500,000
5,000,000
4,500,000
4,000,000
3,500,000
kWh
Jul
Aug
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Month
1993-94
1992-93

Figure 4.2.2.1

4.2.3 Monthly Demand

Electrical demand is the highest rate of electrical energy used during a specified time interval (15 minutes). The measurement of electric demand is expressed as kilowatts (1,000 watts). Electrical demand is not necessarily related to the amount of time the electrical components are in operation. The monthly demand profile for the entire Depot during the previously noted time period is graphically shown in Figure 4.2.3.1.

From Figure 4.2.3.1, on the following page, it can be seen that the billed demand peaks during the summer months.

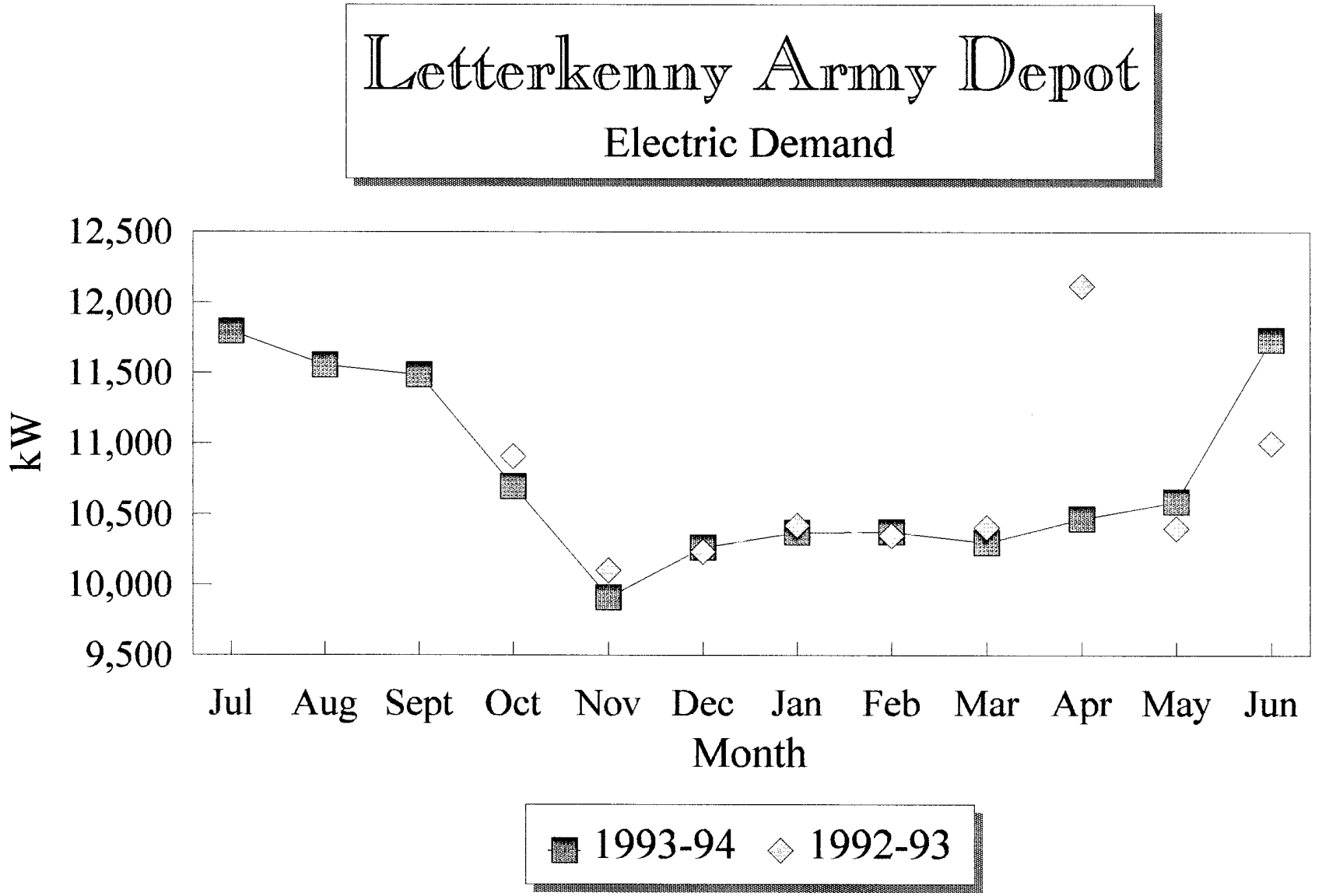

Letterkenny Army Depot
Electric Demand
12,500
12,000
11,500
11,000
10,500
10,000
9,500
kW
Jul
Aug
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Month
1993-94
1992-93

Figure 4.2.3.1

5.0 ENERGY CALCULATIONS

5.1 General

The buildings at Letterkenny Army Depot are not individually metered for electric consumption. The electric usage for the lighting in the surveyed areas was calculated using the lighting models.

A summary of all the buildings' area electric usage was calculated in the energy model. As described in the Methodology Section, both the lighting model and electric model have been used to estimate how energy is used in the surveyed areas. The estimated energy cost became the basis for subsequent Energy Conservation Opportunities (ECOs).

5.2 Lighting Model Summary

Entech created a lighting model for each surveyed building, plus one for the roadway and parking lot areas. The complete set of lighting models for this study is located in Section 9.4. The lighting models reflect the observations made during the walk through. The lighting models create the basis for evaluating energy saving projects.

Figure 5.2.1, Luminaire Type Distribution Summary, depicts the overall luminaire quantity as a function of type. As shown in Figure 5.2.1, over 14,000 total luminaires were surveyed, 78.1% fluorescent, 7.2% incandescent, and 14.7% high-intensity discharge type.

Letterkenny Army Depot

Luminaire Type Distribution Summary

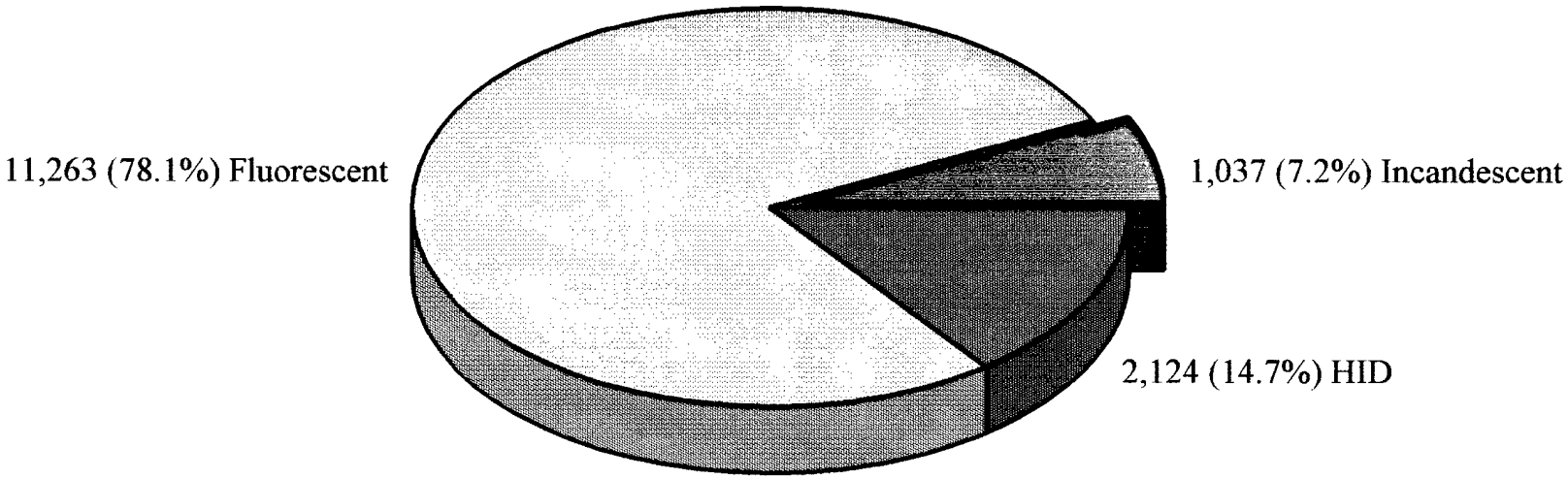


Figure 5.2.1

The annual electric cost associated with each luminaire type is illustrated in Figure 5.2.2, Electric Cost Distribution. The fluorescent lighting surveyed had an annual cost of approximately $244,000. The incandescent and HID lighting surveyed had an annual cost of $20,000 and $66,000 respectively.

Table 5.2.1, Luminaire Summary, summarizes the luminaire quantity, number of lamps, demand, usage, and annual cost for each luminaire type, on a per-building basis.

Letterkenny Army Depot

Electric Cost Distribution

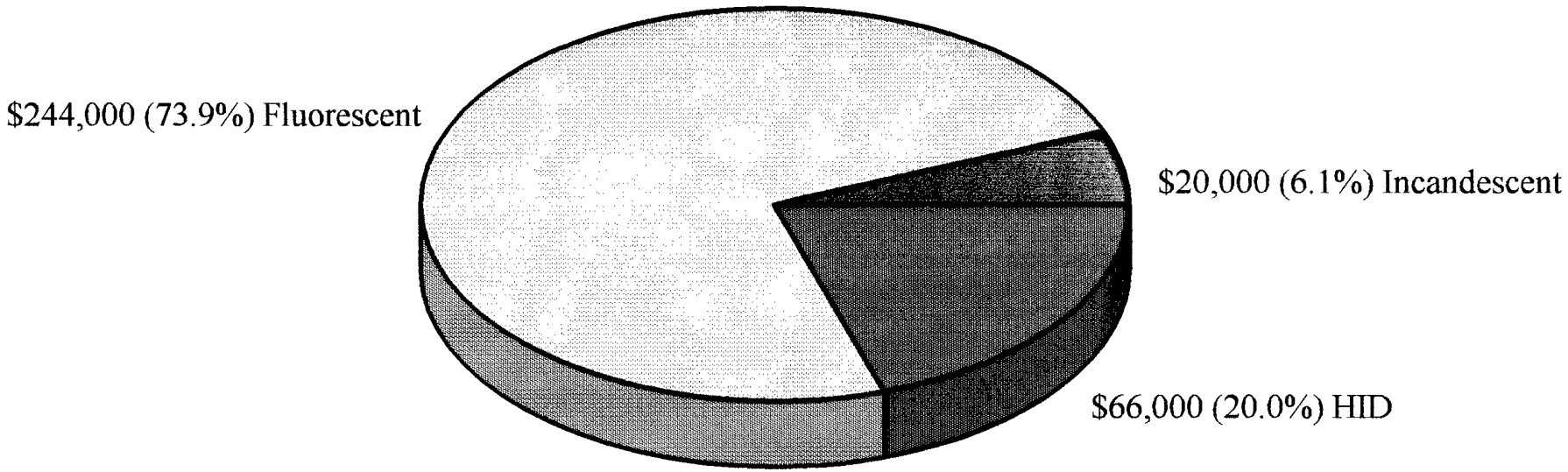


Figure 5.2.2

Letterkenny Army Depot

Luminaire Summary

Table 5.2.1

		Incandscent					Fluorescent					HID				
No.	Description	No. Luminaires	No. Lamps	Demand (kw)	Usage (kwh)	Annual Cost	No. Luminaires	No. Lamps	Demand (kw)	Usage (kwh)	Annual Cost	No. Luminaires	No. Lamps	Demand (kw)	Usage (kwh)	Annual Cost
1	Building 1	36	36	0.02	726	$218	562	1,399	65.77	15059	$10,564	4	4	0.00	240	$71
2	Building 2-S	1	2	0.03	22	$9	234	903	39.17	8918	$6,276	0	0	0.00	0	$0
3	Building 3	40	57	1.31	613	$304	1,372	4,549	185.94	72720	$38,836	26	26	0.00	1557	$463
4	Building 4	10	10	0.00	1042	$310	1,720	3,440	149.67	34210	$24,021	2	2.00	0.00	120	$36
5	Building 5	5	8	0.15	81	$38	144	316	13.73	3138	$2,203	0	0.00	0.00	0	$0
6	Building 6N	8	16	0.23	175	$73	447	1,340	57.18	13052	$9,172	0	0	0.00	0	$0
7	Building 10	48	48	1.56	909	$415	1,082	2,481	106.09	32159	$19,381	4	4	0.00	240	$71
8	Building 14	27	30	0.47	161	$91	216	696	29.50	6777	$4,744	0	0	0.00	0	$0
9	Building 19	36	38	0.84	235	$147	7	17	0.74	170	$119	70	70	18.85	4305	$3,024
10	Building 20-1	0	0	0.00	0	$0	5	14	0.61	140	$98	8	8	1.53	349	$245
11	Building 31	6	6	1.14	260	$183	3	8	0.35	80	$56	152	152	29.06	6638	$4,663
12	Building 32	8	8	1.52	347	$244	5	13	0.57	130	$91	142	142	27.15	6201	$4,356
13	Building 33N	2	2	0.19	43	$30	88	183	8.15	1862	$1,308	5	5	0.82	187	$131
14	Building 34	8	8	1.52	347	$244	17	37	1.62	369	$259	271	271	51.81	11835	$8,313
15	Building 37	0	0	0.00	0	$0	38	142	6.21	2551	$1,333	0	0	0.00	0	$0
16	Building 41	8	8	1.52	347	$244	4	7	0.31	70	$49	165	165	31.55	7206	$5,062
17	Building 42S	3	3	0.19	392	$134	175	639	27.59	6315	$4,431	15	15	2.87	655	$460
18	Building 43	4	4	0.76	174	$122	263	533	23.29	5320	$3,737	0	0	0.00	0	$0
19	Building 44	8	8	1.52	347	$244	13	39	1.70	389	$273	149	149	28.49	6507	$4,571
20	Building 47	25	25	6.37	2492	$1,330	58	106	4.63	1905	$995	158	158	26.11	10736	$5,609
21	Building 51	10	10	1.03	256	$171	367	1,056	45.46	10408	$7,301	137	137	22.45	5128	$3,602
22	Building 52	4	4	0.76	174	$122	5	18	0.44	100	$70	84	84	13.77	3144	$2,209
23	Building 53	4	4	0.76	174	$122	11	35	1.53	349	$245	82	82	13.44	3069	$2,156
24	Building 54	4	4	0.76	174	$122	10	20	0.87	200	$140	84	84	13.77	3144	$2,209
25	Building 55	4	4	0.76	174	$122	1	4	0.17	40	$28	116	116	19.01	4342	$3,050
26	Building 57S	0	0	0.00	0	$0	425	1,346	58.82	24055	$12,598	0	0	0.00	0	$0
27	Building 102	4	8	0.05	35	$15	31	65	2.19	908	$472	4	4	0.00	240	$71
28	Building 199	0	0	0.00	0	$0	7	26	1.14	260	$182	0	0	0.00	0	$0
29	Building 200	0	0	0.00	0	$0	11	44	1.92	439	$309	0	0	0.00	0	$0
30	Building 211	0	0	0.00	0	$0	12	42	1.75	403	$282	1	1	0.00	0	$0
31	Building 247	7	7	0.07	16	$11	31	89	2.45	617	$410	0	0	0.00	0	$0
32	Building 320	20	20	0.60	156	$102	108	196	7.13	4280	$1,933	43	43	17.04	5542	$3,225
33	Building 349	50	50	10.70	5515	$2,630	34	89	3.71	2591	$1,114	0	0	0.00	0	$0
34	Building 350	70	79	5.86	1896	$1,106	179	514	21.85	7968	$4,392	0	0	0.00	0	$0
35	Building 370	8	8	0.67	197	$120	594	2,275	90.04	36933	$19,317	0	0	0.00	0	$0
36	Building 412	6	9	0.28	161	$73	73	284	10.52	2240	$1,639	4	4	0.00	240	$71
37	Building 416	2	4	0.02	17	$7	40	144	5.96	1374	$960	3	3	0.00	0	$0
38	Building 417	1.0	2.0	0.01	10	$4	58.0	119.0	4.30	1783	$929	0.0	0	0.00	0	$0
39	Building 418	1	2	0.01	10	$4	58	119	4.30	1783	$929	0	0	0.00	0	$0
40	Building 421	16	16	0.00	0	$0	164	604	25.41	5807	$4,078	3	3	0.00	0	$0
41	Building 424	53	53	4.18	1687	$889	205	602	26.13	10749	$5,615	12	12	4.15	1707	$892
42	Building 428	2	2	0.10	26	$17	24	52	2.27	519	$365	0	0	0.00	0	$0
43	Building 431	4	4	0.00	0	$0	159	622	26.58	6055	$4,260	2	2	0.00	0	$0

Letterkenny Army Depot

Luminaire Summary

Table 5.2.1

		Incandscent					Fluorescent					HID				
No.	Description	No. Luminaires	No. Lamps	Demand (kw)	Usage (kwh)	Annual Cost	No. Luminaires	No. Lamps	Demand (kw)	Usage (kwh)	Annual Cost	No. Luminaires	No. Lamps	Demand (kw)	Usage (kwh)	Annual Cost
44	Building 438	37	37	9.15	2109	$1,474	3	6	0.26	60	$42	0	0	0.00	0	$0
45	Building 441	57	57	9.41	2148	$1,509	4	12	0.52	120	$84	0	0	0.00	0	$0
46	Building 500	41	51	2.46	1224	$591	427	1,321	53.17	13541	$8,947	0	0	0.00	0	$0
47	Building 521	14	14	0.12	839	$261	106	302	8.26	2783	$1,592	1	1	0.00	60	$18
48	Building 522	13	18	0.56	142	$95	92	303	11.89	2676	$1,896	0	0	0.00	0	$0
49	Building 523	7	7	0.13	38	$23	76	205	8.66	1950	$1,382	0	0	0.00	0	$0
50	Building 524	1	1	0.00	0	$0	49	98	3.19	683	$498	0	0	0.00	0	$0
51	Building 529	140	150	11.29	3318	$2,032	98	308	12.30	3428	$2,158	2	2	0.00	120	$36
52	Building 530	0	0	0.00	0	$0	16	32	1.40	319	$224	0	0	0.00	0	$0
53	Building 536	0	0	0.00	0	$0	22	44	1.92	1476	$617	4	4	0.00	240	$71
54	Building 581	14	18	0.46	121	$79	126	489	19.63	4474	$3,147	0	0	0.00	0	$0
55	Building 616	0	0	0.00	0	$0	8	24	1.05	805	$337	0	0	0.00	0	$0
56	Building 618	10	13	0.14	79	$37	66	176	7.16	1625	$1,146	0	0	0.00	0	$0
57	Building 619	6	8	0.06	101	$35	51	145	5.65	1320	$916	2	2	0.00	120	$36
58	Building 628	6	6	0.00	0	$0	56	163	6.52	1498	$1,049	0	0	0.00	0	$0
59	Building 637	21	21	1.31	364	$229	42	44	1.52	351	$245	0	0	0.00	0	$0
60	Building 639	36	36	6.85	5458	$2,258	80	247	9.75	6240	$2,759	2	2	0.00	120	$36
61	Building 640	0	0	0.00	0	$0	9	36	0.83	144	$119	0	0	0.00	0	$0
62	Building 645	9	14	0.11	225	$77	30	60	2.62	1006	$542	1	1	0.00	60	$18
63	Building 646	3	6	0.09	66	$27	41	94	3.93	2192	$1,016	0	0	0.00	0	$0
64	Building 663	23	23	5.80	1992	$1,129	323	1,030	45.39	18130	$9,593	0	0	0.00	0	$0
65	Building 664	8	8	0.28	77	$49	103	262	10.32	2396	$1,668	0	0	0.00	0	$0
66	Building 2260	5	8	0.18	45	$30	77	306	12.82	2951	$2,064	0	0	0.00	0	$0
67	Building 2329	0	0	0.00	0	$0	17	34	0.75	204	$130	2	2	0.00	120	$36
68	Building 2755	16	28	0.48	264	$123	37	105	4.36	1002	$701	93	93	13.90	5308	$2,865
69	Building 3311	7	7	0.10	41	$21	179	602	25.50	5810	$4,087	0	0	0.00	0	$0
70	Building 3315	5	5	0.36	82	$58	30	68	2.89	663	$464	15	15	2.29	524	$368
71	Building 3321	5	5	0.00	0	$0	13	35	1.53	349	$245	0	0	0.00	0	$0
72	Building 5426	0	0	0.00	0	$0	9	32	1.32	303	$212	2	2	0.00	120	$36
73	Road Ltgs	0	0	0.00	0	$0	13	52	0.00	1661	$494	254	254	0.00	27293	$8,122
	Totals	1,037	1,148	95.28	38128	$20,000	11,263	31,862	1332.87	405355	$244,000	2,124	2,124	338.05	117415	$66,000

G:\PROJECTS\4130.01\SS\EBILL\FIG_5.WK4

18-Apr-95

5.3 Electric Model Summary

The electric model as described in the Methodology Section is shown in Table 5.3.1. The model represents the current operation of the buildings as indicated by Letterkenny Army Depot and observed by Entech Engineering, Inc. The model is typically employed to approximate the annual electric cost contribution from all building electric users. Since this study dealt only with lighting, the model summarizes the building lighting electric usage for the surveyed areas. As noted in Table 5.3.1 on the following page, the study area is over 2 million square feet, has an annual electric usage of 6,723,900 kWh, and an annual demand of 21,228 kW. The annual cost associated with the surveyed lighting was approximately $330,000.

Letterkenny Army Depot

Depot Electric Model Summary

Table 5.3.1

No.	Description	Study Area	Connected Load (kW)		Winter Demand kW/Mo	Inter Demand kW/Mo	Summer Demand kW/Mo	Winter Usage kWh/Mo	Inter Usage kWh/Mo	Summer Usage kWh/Mo	Annual Demand kW/yr	Annual Usage Kwh/yr	Annual Cost $/yr	Study Area $/sf	No.
			Heating	Cooling											
1	Building 1	82,115	75.438	75.438	66	66	66	16,025	16,025	16,025	792	192,300	$10,872	$0.13	1
2	Building 2-S	18,591	41.568	41.568	39	39	39	8,940	8,940	8,940	468	107,280	$6,267	$0.34	2
3	Building 3	93,290	216.612	216.612	187	187	187	74,890	74,890	74,890	2,244	898,680	$39,580	$0.42	3
4	Building 4	96,791	161.585	161.585	150	150	150	35,372	35,372	35,372	1,800	424,464	$24,398	$0.25	4
5	Building 5	13,831	14.746	14.746	14	14	14	3,220	3,220	3,220	168	38,640	$2,253	$0.16	5
6	Building 6N	40,560	61.880	61.880	57	57	57	13,227	13,227	13,227	684	158,724	$9,207	$0.23	6
7	Building 10	49,093	120.341	120.341	108	108	108	33,308	33,308	33,308	1,296	399,696	$19,899	$0.41	7
8	Building 14	9,660	34.706	34.706	30	30	30	6,938	6,938	6,938	360	83,256	$4,839	$0.50	8
9	Building 19	41,705	28.630	28.630	20	20	20	4,709	4,709	4,709	240	56,508	$3,251	$0.08	9
10	Building 20-1	16,800	2.254	2.254	2	2	2	489	489	489	24	5,868	$330	$0.02	10
11	Building 31	90,180	32.158	32.158	31	31	31	6,978	6,978	6,978	372	83,736	$4,943	$0.05	11
12	Building 32	90,180	30.776	30.776	29	29	29	6,678	6,678	6,678	348	80,136	$4,669	$0.05	12
13	Building 33N	45,000	9.842	9.842	9	9	9	2,092	2,092	2,092	108	25,104	$1,455	$0.03	13
14	Building 34	90,180	57.841	57.841	55	55	55	12,551	12,551	12,551	660	150,612	$8,821	$0.10	14
15	Building 37	5,000	6.532	6.532	6	6	6	2,551	2,551	2,551	72	30,612	$1,314	$0.26	15
16	Building 41	90,180	35.128	35.128	33	33	33	7,623	7,623	7,623	396	91,476	$5,320	$0.06	16
17	Building 42S	50,927	33.688	33.688	31	31	31	7,362	7,362	7,362	372	88,344	$5,058	$0.10	17
18	Building 43	90,527	25.318	25.318	24	24	24	5,494	5,494	5,494	288	65,928	$3,854	$0.04	18
19	Building 44	90,180	33.380	33.380	32	32	32	7,244	7,244	7,244	384	86,928	$5,115	$0.06	19
20	Building 47	91,244	39.234	39.234	37	37	37	15,132	15,132	15,132	444	181,584	$7,925	$0.09	20
21	Building 51	85,559	74.231	74.231	69	69	69	15,793	15,793	15,793	828	189,516	$11,081	$0.13	21
22	Building 52	90,180	16.118	16.118	15	15	15	3,418	3,418	3,418	180	41,016	$2,404	$0.03	22
23	Building 53	90,180	16.555	16.555	16	16	16	3,592	3,592	3,592	192	43,104	$2,549	$0.03	23
24	Building 54	90,180	16.210	16.210	15	15	15	3,518	3,518	3,518	180	42,216	$2,434	$0.03	24
25	Building 55	90,180	20.994	20.994	20	20	20	4,556	4,556	4,556	240	54,672	$3,205	$0.04	25
26	Building 57S	55,598	61.916	61.916	59	59	59	24,055	24,055	24,055	708	288,660	$12,615	$0.23	26
27	Building 102	1,750	3.728	3.728	2	2	2	1,183	1,183	1,183	24	14,196	$537	$0.31	27
28	Building 199	960	1.196	1.196	1	1	1	260	260	260	12	3,120	$170	$0.18	28
29	Building 200	1,063	2.024	2.024	2	2	2	439	439	439	24	5,268	$316	$0.30	29
30	Building 211	856	2.105	2.105	2	2	2	403	403	403	24	4,836	$305	$0.36	30
31	Building 247	2,946	4.619	4.619	3	3	3	633	633	633	36	7,596	$466	$0.16	31
32	Building 320	65,761	28.112	28.112	25	25	25	9,978	9,978	9,978	300	119,736	$5,281	$0.08	32
33	Building 349	17,887	18.269	18.269	14	14	14	8,106	8,106	8,106	168	97,272	$3,707	$0.21	33
34	Building 350	7,817	30.014	30.014	28	28	28	9,864	9,864	9,864	336	118,368	$5,525	$0.71	34
35	Building 370	20,000	95.576	95.576	91	91	91	37,131	37,131	37,131	1,092	445,572	$19,465	$0.97	35
36	Building 412	7,890	14.194	14.194	11	11	11	2,641	2,641	2,641	132	31,692	$1,803	$0.23	36
37	Building 416	3,106	7.166	7.166	6	6	6	1,391	1,391	1,391	72	16,692	$969	$0.31	37
38	Building 417	3,960	5.465	5.465	4	4	4	1,793	1,793	1,793	48	21,516	$903	$0.23	38
39	Building 418	3,960	5.465	5.465	4	4	4	1,793	1,793	1,793	48	21,516	$903	$0.23	39

Letterkenny Army Depot

Depot Electric Model Summary

Table 5.3.1

No.	Description	Study Area	Connected Load (kW)		Winter Demand kW/Mo	Inter Demand kW/Mo	Summer Demand kW/Mo	Winter Usage kWh/Mo	Inter Usage kWh/Mo	Summer Usage kWh/Mo	Annual Demand kW/yr	Annual Usage Kwh/yr	Annual Cost $/yr	Study Area $/sf	No.
			Heating	Cooling											
40	Building 421	14,850	29.902	29.902	25	25	25	5,087	5,087	5,087	300	61,044	$3,826	$0.26	40
41	Building 424	6,630	38.263	38.263	35	35	35	14,222	14,222	14,222	420	170,664	$7,469	$1.13	41
42	Building 428	1,520	2.592	2.592	2	2	2	545	545	545	24	6,540	$347	$0.23	42
43	Building 431	12,870	30.727	30.727	27	27	27	6,055	6,055	6,055	324	72,660	$4,299	$0.33	43
44	Building 438	3,667	11.376	11.376	9	9	9	2,169	2,169	2,169	108	26,028	$1,478	$0.40	44
45	Building 441	13,601	17.652	17.652	10	10	10	2,268	2,268	2,268	120	27,216	$1,600	$0.12	45
46	Building 500	34,552	63.520	63.520	56	56	56	14,765	14,765	14,765	672	177,180	$9,572	$0.28	46
47	Building 521	1,955	16.367	16.367	8	8	8	3,752	3,752	3,752	96	45,024	$1,856	$0.95	47
48	Building 522	9,663	15.569	15.569	12	12	12	2,818	2,818	2,818	144	33,816	$1,948	$0.20	48
49	Building 523	5,964	10.160	10.160	9	9	9	1,989	1,989	1,989	108	23,868	$1,424	$0.24	49
50	Building 524	1,305	4.568	4.568	3	3	3	683	683	683	36	8,196	$481	$0.37	50
51	Building 529	8,424	26.712	26.712	24	24	24	6,866	6,866	6,866	288	82,392	$4,263	$0.51	51
52	Building 530	1,039	1.472	1.472	1	1	1	319	319	319	12	3,828	$187	$0.18	52
53	Building 536	1,200	2.714	2.714	2	2	2	1,715	1,715	1,715	24	20,580	$695	$0.58	53
54	Building 581	9,702	23.894	23.894	20	20	20	4,595	4,595	4,595	240	55,140	$3,217	$0.33	54
55	Building 616	280	1.104	1.104	1	1	1	805	805	805	12	9,660	$332	$1.19	55
56	Building 618	5,167	9.446	9.446	7	7	7	1,704	1,704	1,704	84	20,448	$1,154	$0.22	56
57	Building 619	3,171	7.802	7.802	6	6	6	1,540	1,540	1,540	72	18,480	$1,013	$0.32	57
58	Building 628	5,278	8.698	8.698	7	7	7	1,498	1,498	1,498	84	17,976	$1,093	$0.21	58
59	Building 637	1,400	4.194	4.194	3	3	3	715	715	715	36	8,580	$490	$0.35	59
60	Building 639	9,466	19.253	19.253	17	17	17	11,818	11,818	11,818	204	141,816	$5,089	$0.54	60
61	Building 640	1,256	1.656	1.656	1	1	1	144	144	144	12	1,728	$135	$0.11	61
62	Building 645	1,920	3.451	3.451	3	3	3	1,291	1,291	1,291	36	15,492	$662	$0.34	62
63	Building 646	2,778	4.414	4.414	4	4	4	2,258	2,258	2,258	48	27,096	$1,042	$0.38	63
64	Building 663	12,139	53.883	53.883	51	51	51	20,122	20,122	20,122	612	241,464	$10,704	$0.88	64
65	Building 664	4,074	12.450	12.450	11	11	11	2,474	2,474	2,474	132	29,688	$1,753	$0.43	65
66	Building 2260	4,000	14.500	14.500	13	13	13	2,995	2,995	2,995	156	35,940	$2,093	$0.52	66
67	Building 2329	1,152	1.909	1.909	1	1	1	323	323	323	12	3,876	$189	$0.16	67
68	Building 2755	12,167	22.146	22.146	19	19	19	6,574	6,574	6,574	228	78,888	$3,713	$0.31	68
69	Building 3311	6,499	28.992	28.992	26	26	26	5,851	5,851	5,851	312	70,212	$4,146	$0.64	69
70	Building 3315	9,000	6.096	6.096	6	6	6	1,269	1,269	1,269	72	15,228	$932	$0.10	70
71	Building 3321	4,108	2.160	2.160	2	2	2	349	349	349	24	4,188	$289	$0.07	71
72	Building 5426	624	1.817	1.817	1	1	1	423	423	423	12	5,076	$218	$0.35	72
73	Road Ltgs		83.392	83.392	0	0	0	28,954	28,954	28,954	0	347,448	$8,617		73
	Totals	2,047,288	2,068	2,068	1,769	1,769	1,769	560,325	560,325	560,325	21,228	6,723,900	$330,000	$0.16	

6.0 ENERGY CONSERVATION OPPORTUNITIES

6.1 General

The items discussed in this section of the report are the result of the investigation of several energy cost reduction strategies. A summary table of all the Energy Conservation Opportunities (ECOs) investigated is shown in Table 6.1.1. The ECOs are arranged from the highest to lowest savings to investment ratio. The ECO write up addresses the following:

Existing, discusses the current operational levels and approximate costs.

Proposed, presents a new concept designed to save energy; however, it should be understood that the actual design has not yet been performed. Arrangements and quantities may change somewhat during design.

Implementation Cost, covers materials, labor, and indirect costs needed for a complete project, including associated engineering design. Escalation is not included. Costs are in 1995 dollars.

Energy Savings, shows an expected level of annual cost savings; however, does not include price increases of various energy sources or interactive savings. The ECOs are calculated on a stand-alone basis.

Maintenance Savings, details the proposed maintenance savings resulting from implementing the ECO.

Discussion, notes the results of the life cycle cost summary.

Table 6.1.1
ECO Summary
Letterkenny Army Depot

ECO No.	ECO Description	Implementation Cost $	Energy Savings mmBtu	LCCID Simple Payback (Yrs)	LCCID SIR
ECO-3	Incandescent Area Light over Paper Exit Sign	$4,600	88.3	1.83	9.54
ECO-15	Building Exterior Lighting	$7,000	102.4	2.14	8.13
ECO-4A	Incandescent Area Lighting Retrofit	$9,700	135.4	2.39	6.72
ECO-4B	Incandescent Area Lighting Fixture Replacement	$24,000	254.5	2.75	6.33
ECO-5	HID Lighting	$41,000	531.4	2.88	6.06
ECO-2	Incandescent Exit Signs to LED Exit Signs	$6,400	61.2	3.03	5.74
ECO-1	Incandescent Exit Signs to Fluorescent Exit Signs	$4,900	50.1	3.76	4.64
ECO-7	Fluorescent Lamp Retrofit	$145,000	1859	5.77	3.07
ECO-12	Occupancy Sensors	$2,900	56.9	7.19	2.45
ECO-11	Industrial Fluorescent to High Pressure Sodium	$261,000	1554	8.83	1.99
ECO-9	Fluorescent Reflectors	$180,000	1427	9.45	1.87
ECO-6	Efficient Fluorescent Lighting Retrofit	$628,000	4607	9.92	1.78
ECO-8	Efficient Fluorescent Fixture Replacement	$879,000	4426	14.6	1.21
ECO-10	Industrial Fluorescent to Metal Halide	$357,000	840	21.64	0.81
ECO-13	Mercury Vapor to Metal Halide	$508,000	733.8	42.44	0.42
ECO-14	Mercury Vapor to High Pressure Sodium	$518,000	733.8	42.93	0.41
ECO-16	Roadway and Parking Area Lighting	$51,000	260	45.22	0.41

23-May-95

6.2 Recommended ECOs

6.2.1 General

The criteria to meet the ECIP Program is a simple payback period of less than ten (10) years plus a savings to investment ratio (SIR) greater than 1.25. Twelve (12) of the seventeen (17) ECOs investigated meet the above criteria. In several cases, multiple options for a single-existing condition were investigated. In these cases, the option which was determined to best suit the Depot was recommended. Table 6.2.1 list the recommended ECOs. The ECOs listed in the table are arranged in numerical order.

6.2.2 Recommendation Evaluation

ECO-1 and ECO-2 both discuss options to replace the existing incandescent exit signs. ECO-1 proposes fluorescent retrofit kits. ECO-2 proposes LED retrofit kits. Both ECOs met the ECIP simple payback and SIR requirements. ECO-2 was recommended over ECO-1 because it saved the most energy and had a better simple payback period and SIR.

ECO-3 proposed replacing the incandescent lamps, which are illuminating paper exit signs, with new LED exit signs. This ECO is recommended because of the quick payback period and large energy savings.

ECO-4A and ECO-4B discuss options to replace the existing incandescent area lighting. ECO-4A proposes a lamp retrofit and ECO-4B proposes a luminaire retrofit.

Even though both ECOs have good payback periods, ECO-4B is recommended because of the larger energy savings. ECO-4A could be implemented as part of the current regular maintenance, while funding for ECO-4B is being processed.

ECO-5 addresses the replacement of incandescent lighting with high-intensity discharge type luminaires. ECO-5 is recommended because of a good annual maintenance savings and corresponding payback period.

ECOs-6, 7, 8, and 9 all address the existing fluorescent lighting. ECO-6 proposes a T-8 retrofit while ECO-7 proposes a reduced wattage lamp retrofit. ECO-8 proposes a luminaire replacement and ECO-9 proposes delamping and adding a reflector. ECOs-6, 7, and 9 meet the ECIP simple payback and SIR requirements. ECO-6 is recommended because it address the most areas resulting in the largest energy savings. Since most of the existing fluorescent ballast are reaching the end of their useful life, this ECO will reduce future maintenance cost.

ECO-11 proposes to remove the industrial fluorescent lighting and replace it with high-pressure sodium lighting. This ECO is recommended; however, the Depot should verify that the listed buildings' operation can function efficiently with the use of high-pressure sodium luminaires.

During the evening site investigation, several unoccupied areas were found lit. ECO-12 proposes to provide occupancy sensors to automatically turn lights off when the area is unoccupied. ECO-12 is recommended.

ECO-15 addresses the incandescent building-mounted exterior lighting for eleven (11) buildings. ECO-15 proposes to replace the existing incandescent lighting with high-pressure sodium wall pack units. ECO-15 is recommended.

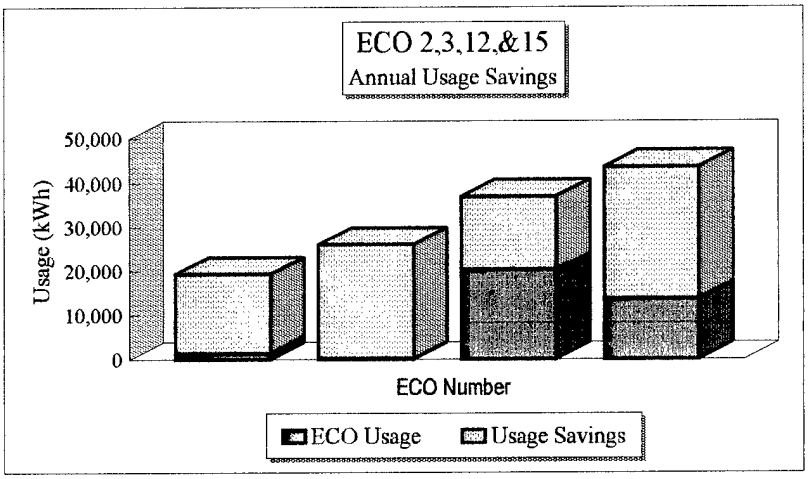
Figure 6.2.2.1, Annual Usage Savings, contains three (3) graphs depicting the annual ECO usage and the annual usage saved as a result of implementing the ECO. For example, in the first chart for ECO-12, the sum of the two blocks (ECO Usage and ECO Savings) is equal to approximately 37,000 kWh, which is the current usage of the existing luminaires noted in the ECO-12 spreadsheet. The *red* block (ECO Usage) is the proposed usage if ECO-12 is implemented. The *green* block represents the usage saved by implementing ECO-12. Should ECO-12 be implemented, the savings would be approximately 16,000 kWh, as shown on the graph.

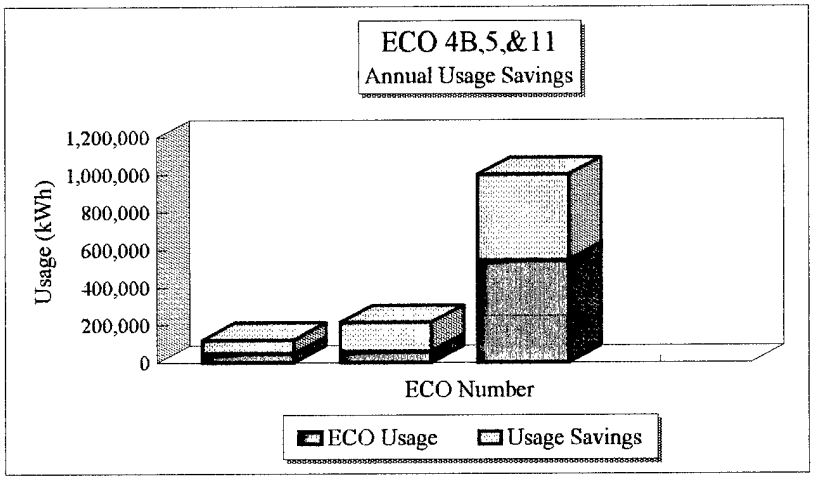
Table 6.2.1
Recommended ECO's
Letterkenny Army Depot

ECO No.	ECO Description	Implementation Cost $	Energy Savings mmBtu	LCCID Simple Payback (Yrs)	LCCID SIR
ECO-2	Incandescent Exit Signs to LED Exit Signs	$6,400	61.2	3.03	5.74
ECO-3	Incandescent Area Light over Paper Exit Sign	$4,600	88.3	1.83	9.54
ECO-4B	Incandescent Area Lighting Fixture Replacement	$24,000	254.5	2.75	6.33
ECO-5	HID Lighting	$41,000	531.4	2.88	6.06
ECO-6	Efficient Fluorescent Lighting Retrofit	$628,000	4607	9.92	1.78
ECO-11	Industrial Fluorescent to High Pressure Sodium	$261,000	1554	8.83	1.99
ECO-12	Occupancy Sensors	$2,900	56.9	7.19	2.45
ECO-15	Building Exterior Lighting	$7,000	102.4	2.14	8.13
Total		**$1,000,000**	**7300**		

Letterkenny Army Depot

Annual Usage Savings





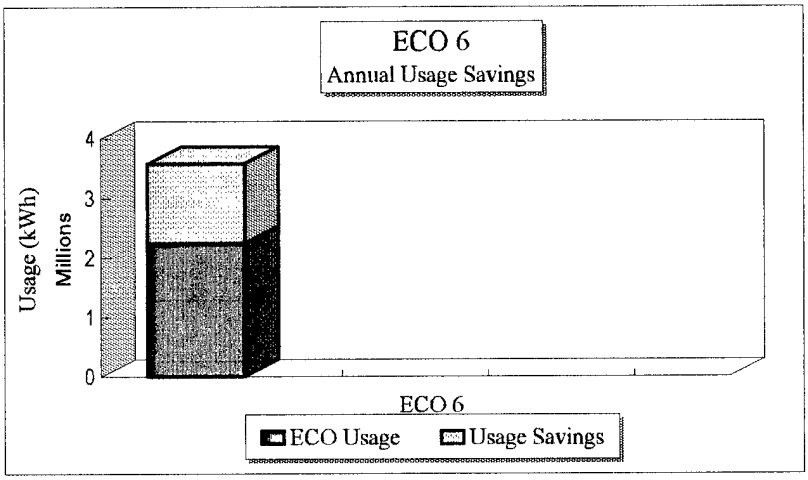


Figure 6.2.2.1

1. COMPONENT

Army

2. DATE

15 Sept 95

FY 1996 MILITARY CONSTRUCTION PROJECT DATA

3. INSTALLATION & LOCATION

Letterkenny Army Depot
Chambersburg, PA

4. PROJECT TITLE

Energy Conservation - Lighting Retrofit

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST($000)
		1109	

9. COST ESTIMATES

ITEM	U/M	QTY	UNIT COST	COST ($000)
Efficient fluorescent lighting retrofit	LS	1	578	(578)
Industrial fluorescent to high pressure sodium retrofit	LS	1	233	(233)
SUBTOTAL				811
Contingency (20%)				162
TOTAL CONTRACT COST				973
SIA (5.5%)				54
TOTAL REQUEST				1027
Design (8% Unfunded)				82
TOTAL PROJECT COST				1109

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Work to be performed consists of replacing approximately 7382 fluorescent luminaires of various types, Depot wide, with an energy efficient T-8 fluorescent lighting system. In addition, approximately 3,120 fluorescent luminaires will be replaced with more efficient high pressure sodium light sources.

11. REQUIREMENT: 7,200 SF; ADEQUATE: 0 SF; SUBSTANDARD: 7,200 SF

PROJECT: In conjunction with the Army's Energy Engineering Analysis Program (EEAP), a detailed report of the Depots lighting systems was performed. The report researched, identified, evaluated, and defined several energy saving projects that meet the Army's criteria and lead to electric energy savings at the Letterkenny Depot. Two of the projects from the report which were found to save the most energy are the Efficient Fluorescent Lighting Retrofit, Energy Conservation Opportunity Number 6 and the Industrial Fluorescent to High Pressure Sodium, Energy Conservation Opportunity Number 11. The implementation of this project based on the above mentioned report would save an estimated 6161 mmBTU's of energy. In addition, more efficient lighting systems are less expensive to operate.

CURRENT SITUATION: The Depot's current lighting system consists of approximately 78% fluorescent, 15% high intensity discharge, and 7% incandescent light sources. The current fluorescent lighting system consists mostly of conventional magnetic ballast and 40 watt T-12 lamps.

1. COMPONENT

Army

2. DATE

15 Sept 95

FY 1996 MILITARY CONSTRUCTION PROJECT DATA

INSTALLATION & LOCATION

Letterkenny Army Depot
Chambersburg, PA

4. PROJECT TITLE

Energy Conservation - Lighting Retrofit

5. PROJECT NUMBER

11. REQUIREMENT: (cont'd)

IMPACT IF NOT PROVIDED: If this project is not completed, the Depot will be utilizing more electric energy for lighting then is necessary, resulting in higher than necessary operating costs to the Government. The reduction in electric energy will not only save the Depot money on its electric bill, but according to the U.S. Environmental Protection Agency, it will contribute to the reduction of carbon dioxide, sulfur dioxide, and nitrogen oxide in the atmosphere.

JAMES P. FAIRALL, JR.
Colonel, OD
Commanding

6.3 Non-recommended ECOs

In addition to the ECOs listed in Section 6.2.2, the following ECOs were investigated:

- ECO-10 Industrial Fluorescent to Metal Halide
- ECO-13 Mercury Vapor to Metal Halide
- ECO-14 Mercury Vapor to High-Pressure Sodium
- ECO-16 Roadway and Parking Area Lighting

The above ECOs did not meet the ECIP requirements. These ECOs are not recommended due to their long payback periods. These projects may still be attractive to Letterkenny Army Depot due to non-economical factors such as increased worker comfort/performance or a reduction in maintenance. These projects, which are currently not economically feasible, should be considered when replacement of the existing equipment is required.

7.0 OPERATION AND MAINTENANCE PRACTICES

7.1 Operation and Maintenance

Operation and Maintenance (O&M) items are those energy conservation ideas with small costs and payback periods of one year or less. O&M items are usually performed in the normal course of the operation of the building. No O&M items were found during this study.

8.0 CONCLUSION

8.1 Synopsis of Findings

The lighting survey performed included over 14,000 luminaires, encompassing over 2 million square feet.

Eight (8) ECO projects are recommended with a total implementation cost of approximately 1 million dollars and an energy savings of 2.1 million kWh. Table 8.1.1, Recommended ECOs, located at the end of this section, list the implementation cost and energy savings.

8.2 Future Energy Costs

Energy conservation is becoming an increasingly important factor. As energy prices increase, the incentive to conserve energy also increases.

One method of predicting future energy costs is to use an average fuel escalation rate. If an annual increase in energy costs is assumed to be 2%, the following cost would occur assuming there would be no added loads:

TABLE 8.2.1 Energy Rate Increase		
Year	**Existing Energy Costs**	**Energy Cost after ECOs**
1995	$330,000	$225,000
1996	$337,000	$230,000
1997	$344,000	$235,000
1998	$351,000	$240,000
1999	$358,000	$245,000
TOTALS	$1,720,000	$1,175,000

The energy cost savings for the above five-year period, assuming a 2% annual escalation rate, would be $545,000 ($1,720,000 — $1,175,000).

Table 8.1.1
Recommended ECO's
Letterkenny Army Depot

ECO No.	ECO Description	Implementation Cost $	Energy Savings mmBtu
ECO-2	Incandescent Exit Signs to LED Exit Signs	$6,400	61.2
ECO-3	Incandescent Area Light over Paper Exit Sign	$4,600	88.3
ECO-4B	Incandescent Area Lighting Fixture Replacement	$24,000	254.5
ECO-5	HID Lighting	$41,000	531.4
ECO-6	Efficient Fluorescent Lighting Retrofit	$628,000	4607
ECO-11	Industrial Fluorescent to High Pressure Sodium	$261,000	1554
ECO-12	Occupancy Sensors	$2,900	56.9
ECO-15	Building Exterior Lighting	$7,000	102.4
Total		**$1,000,000**	**7300**